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ABSTRACT

This volume presents selected papers from a conference on college teaching and learning, which promotes experimentation in the teaching process and honors educators' efforts in the field. Titles are: (1) "Journey into Technological Integration: Key Steps and Strategies" (G. Aloia, K. Rhee, and M. Aloia); (2) "The Internet-Based Operations Simulation Game" (P. Carr and G. Groves); (3) "Guiding Students in the Research Writing Process" (A. Carreiro); (4) "Web-Based Histotechnology Courses: A Year's Perspective" (M. Carter and D. Lewis); (5) "Information Literacy -- Teaching and Learning Strategies" (R. Catts and M. Appleton); (6) "Biology On-Line: An Issues Oriented Approach for General Education" (W. Conley, J. Gartner, Jr., and A. Monroe); (7) "Using Problem-Based Learning in the Literature Classroom" (W. Hunter); (8) "Creating and Maintaining Course Home Pages -- An Effective Way To Use the Web To Enhance the Classroom" (Z. Jiang and E. McClintock); (9) "Collaborative Research Writing Using the Internet" (C. Marr); (10) "Art and Hi-Tech in Physics Learning" (V. Niculescu and P. Turner); (11) "Virtual Courseware for Science Education: Virtual Flylab and Virtual Earthquake" (G. Novak and R. Desharnais); (12) "Action Learning and Management Development: Lessons for Web-Based Education" (S. Reeve); (13) "Improving Student Learning through Better Designed Web-Based Course Environments" (J. Ross); (14) "A Hybrid CD-ROM/Internet Introduction to Music Course" (D. Sonnenschein); (15) "Using a Bulletin Board System for Collaborative, Cross-Cultural Learning" (R. Spear and N. Pillay); (16) "Exploring Factors That Moderate Learning and Teaching in a Web-Based Course" (J. Tyler and D. Baylen); (17) "Literacy in the Age of Information Overload" (S. Walter); (18) "Ongoing Assessment of the Use of Self-Paced Computer-Assisted Learning Modules in Music Appreciation" (E. Woodruff and S. Brown); and (19) "Classic Systems, Current Insights: Technology Unplugged" (A. Wyandotte). (MAB)

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The Center
for the Advancement of
Teaching and Learning

SELECTED PAPERS
from the
9TH INTERNATIONAL CONFERENCE
on
COLLEGE TEACHING AND LEARNING

Edited by
Jack A. Chambers

**Florida Community College
at Jacksonville**

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FOREWORD

The Center for the Advancement of Teaching and Learning was developed in 1987 when Florida Community College at Jacksonville (FCCJ) accepted K. Patricia Cross' challenge to use the classroom as a modern laboratory for conducting experiments to gauge the impact of teaching on student learning.

The Center, with the philosophy that classroom teachers are the key to improving student learning, is composed of faculty members under the guidance of a steering committee which consists of faculty from each of five campuses of Florida Community College. Part of the Center's success can be attributed to the numerous opportunities given to faculty to test their teaching ideas and to put research results into practice.

The Center sponsors programs supporting faculty research mini-grants, case studies, portfolios, classroom research, cooperative learning, faculty workshops, and adjunct faculty development. In recent years, the Center received the Theodore M. Hesburgh Certificate of Excellence for its faculty development programs.

In an effort to stimulate creative discussion and promote experimentation to improve the teaching/learning process, as well as to honor those who have already significantly improved learning in higher education, the Center annually sponsors an international conference. The conference features recognized educational leaders in diverse areas of teaching, learning and technology. Since its inception, the conference has grown yearly and now attracts over a thousand scholars from around the world. This annual publication, *Selected Papers*, resulted from faculty interest in preserving and communicating some of the outstanding contributions to each conference.

Many people are responsible for the success of the *Ninth International Conference on College Teaching and Learning* that was held in Jacksonville, Florida, April 15-18, 1998. Thanks to all participants--featured speakers and workshop leaders; presenters from universities, liberal arts and community colleges throughout the United states and abroad; and faithful attendees. A special thanks to the Steering Committee for The Center for the Advancement of Teaching and Learning and to Bill Martin, Jack Chambers, Brenda Boccard, John Mullins, B.J. Schukis, Sheila Bambacus, Judy Robbins, Elizabeth Watson, Edith Cooper, Edna Taylor, Ida Brown and Dennis Lewis.

Like the International Conference, this journal continues to grow and broaden its focus. This year's publication contains 20 articles from the *Ninth International Conference on College Teaching and Learning* which represent a cross-section of the nearly 300 faculty presentations. More than 85 papers were submitted for consideration in this year's journal. Those that were selected for inclusion were juried by FCCJ faculty members.

Papers were judged on the following criteria:

Quality of content.

Quality of writing and presentation

Focus of the paper (i.e., teaching, learning, technology)

Discipline

Appeal to an audience of professional, post-secondary educators

Theoretical or practical applications

We hope you will find the ideas presented herein applicable and inspirational to your own research and teaching. Please plan to join us at the *Tenth International Conference on College Teaching and Learning*, April 14-17, 1999, in Jacksonville.

Carolyn Phanstiel
Professor of English

John Mullins	Joann Carpenter
Professor of Biology	Professor of History

JOURNEY INTO
TECHNOLOGICAL INTEGRATION:
KEY STEPS AND STRATEGIES

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Illinois State University

Kun Min Rhee
Taegu University, S. Korea

Mary-Cecilia Aloia
Indiana University

> *We have learned that you have to encourage learning by doing, that the learning has to be relevant to classroom experience and that you need to model good practice.*
>
> Harrington-Luker, 1996, p. 37

INTRODUCTION

James Burke and Robert Ornstein (1997) in their masterful work, *The Axemaker's Gift*, note that the rate and the magnitude of technological change stimulated by the computer are staggering. Although the process of change in itself is often perceived as uncomfortable, it can easily become threatening when coupled with technology. When the mixture consists of change, technology and adult learners --specifically well-educated faculty--the challenges presented can be overwhelming.

Whether an institution approaches the transition to technology incrementally or in one massive undertaking, such as the University of Florida (McCollum, 1998), and regardless if its policy is one of enabling, encouraging, enticing or even coercing faculty to employ the technology, there are five significant hurdles to overcome. They are:

> What are the basic *minimal* technical competencies that a faculty member will need for integrating technology into instruction?
>
> Once the essential technical skills are acquired at a functional level, how does the faculty member manage the massive amounts of information found on the Internet?
>
> Having *culled* through the digital reams of data on the Internet and identified potential Web sites, how does the faculty member evaluate them for their instructional merits?
>
> After a Web site has been selected for integration into the instruction, where is this technological component to be placed in the teaching sequence?
>
> What are some effective strategies that will facilitate the incorporation of technology in classes?

MINIMAL TECHNICAL COMPETENCIES

What are the basic *minimal* technical competencies that a faculty member will need for integrating technology into instruction? Aloia, et. Al. (In press) identified a basic profile of functional competencies necessary for using technology effectively in the classroom. They include the following:

Operating Systems. An understanding of the basic organization and operation of a computer is fundamental to the utilization of Internet technology. One of the most widely used operating systems is *Windows95* (Microsoft, 1995)..

E-mail. Electronic communication enables an efficient and timely exchange of text, graphics, web pages and other attachments. Its asynchronous nature allows for communication to be both continuous and yet under the control of the sender to reply when it is convenient. One very popular e-mail program is *Eudora* (Qualcomm, 1998).

Web Browsers. The two dominant web browsers for the Internet are *Netscape* (1998) and *Internet Explorer* (Microsoft, 1997). They are free to educational institutions and are indispensable in using the Internet.

Web Search Engines. Search engines enable the user to find information on the Internet. If the Internet is to be a functional and usable tool for teaching, the use of search engines is fundamental. (See below for a list of strategies for efficiently searching the Web.) The following represents a sample listing of search engines available on the Internet:

AltaVista: <http://www.altavista.com/>

MetaCrawler:<http://www.metacrawler.com>

Infoseek: <http://www.infoseek.com/>

Yahoo!: <http://www.yahoo.com/>

Web Site Development and Editing. Development of Web pages is directly related to the effectiveness of the Internet for instruction. Faculty skills in Web page development and editing will provide: 1) information to students; 2) links to other sites; and 3) greater opportunities and potential for students to learn. Two very popular programs are *FrontPage* (Microsoft, 1998) and *Communicator* (Netscape, 1998).

Web Site Evaluation. Using the Internet for instruction requires the ability to assess the quality, usability and functionality of information found on web sites. Since there are no filters, qualifiers or restrictions placed on the information that eventually gets on the Internet, the ability to evaluate a web site is essential. Factors that should be considered include: *information, creators, aesthetics, technology and maintenance* (Aloia, 1998a; Bakken & Aloia, in press; and Reigle, 1994).

MANAGING INFORMATION ON THE WORLD WIDE WEB

Once the essential technical skills are acquired at a functional level, how does the faculty member manage the massive amounts of information found on the Internet? Although this topic is too extensive for the scope of this paper, several basic strategies will be presented. For more detailed information, please refer to <www.ice.net/~edutech/floridaweb/>.

Educators searching the Internet for material to enhance, embellish, and enrich their teaching should be cognizant of the following six ***Rules of Engagement***:

Rule 1. No matter how advanced Internet search engines may be, they cannot keep pace with the evolving and amorphous nature and chaotic pace of the Internet. It is impossible to completely track the number of Web sites being created, modified and updated, as well as those that are inaccessible, discontinued or moved.

Rule 2. The terminology used with the Internet is still evolving. Although terms such as *search site*, *search engine*, *Internet directories* and *search directories* appear to be different, they are often used interchangeably and refer essentially to any online program that accepts queries and returns a list of links to relevant web sites.

Rule 3. The same query may generate varying results from different search engines for many reasons. For example, each search engine employs its own set of query syntax and database of Web sites that have been registered on the specific search engine.

Rule 4. Perhaps the most important factors that can affect the Internet searching experience are modem speed and engine popularity. With the heavy graphical content of many sites, a 28.8 Kbps modem is fast becoming a "MESS" (minimally endurable slow speed). Very popular search engines (such as AltaVista) may tend to have a longer wait for a connection which can be worsened during lunch hours, evenings, and weekends.

Rule 5. Privacy is a continual issue on the Internet. The sheer quantity and indiscriminate accessibility of information--from a person's newsgroup postings to phone numbers and street addresses--have raised serious concerns. There are issues of security, access and, in particular, the intrusion of "cookies" (define).

Rule 6. There are two major types of search engines: indexes and metasearchers. Indexes are the most common type of search engine. A metasearcher simply submits a single query to multiple indexes, but allows fewer query options than an index. Although each search engine has its unique query syntax, it is possible to delineate a few universal strategies that are effective in the major search indexes: *quotation marks, the plus sign,* and *the minus sign.* For example, to search using quotation marks, place the words to be searched inside of the quotation marks *as a group and in exact order (e.g. "great barrier reef").*

EVALUATING WEB SITES

Having "culled" through the digital reams of data on the Internet and identified potential web sites, how does the faculty member evaluate them for their instructional merits? An Internet Website Evaluation Scale has been developed by Aloia (1998a). It represents an extension of the work of Reigle (1994) and Bakken & Aloia (in press). The evaluation scale assesses five major components of a website: 1) information; 2) creators; 3) aesthetics; 4) technology; and 5) maintenance. (Please refer to the Internet Website Evaluation Scale (IWES) at <http://www.ice.net/~edutech.floridaweb/>.

Each of these five major components is further expanded with specific site attributes and descriptors that provide greater specificity for evaluating a Website. For example, "maintenance" has two site attributes: "updating" and "copyright." Updating is further delineated by the following descriptors: "site is updated regularly" and "most recent date of editing is provided."

The IWES provides an instructor with a useful framework for deciding whether a particular Website can be of instructional value. The scale enables informed judgments on a wide range of factors. For example, in evaluating a Website to supplement a course's reading assignments, a professor would assess the Website for clearly written, high-quality information, with adequate coverage of the topic and replete with up-to-date references germane to the subject matter. In addition, the Website under consideration could also be assessed for author credibility, institutional affiliation, accessibility and responsiveness to queries. Since literally anyone can place information on the Internet, the credibility of the author is crucial. Without some way of validating the creator's credentials, the Website could be authored by anyone from a Nobel Laureate to the "Unabomber."

Given the visual nature of the Internet, the Website has to have sustaining power (i.e. able to sustain the attention/interest of the learner for the desired duration of the learning) or it will fail to achieve its goal of enhancing or facilitating learning. The aesthetic value of the design is also a consideration.

The technology incorporated into the Website will also play a role in defining its educational value. Is it easily navigable, both internally and externally? Does it have a "Homepage"? Is it a commercial (.com) or an educational site (.edu)? Is it accessible to persons with disabilities? Is downloading the site too time consuming? Last, is the site maintained on a regular basis? Given the speed with which the world of technology is changing (Burke & Ornstein, 1997), it does not take long for a site to become dated and stale.

PLACEMENT WITHIN THE TEACHING SEQUENCE

After a web site has been selected for integration into instruction, where is this technological component to be placed in the teaching/learning sequence? Aloia (1998b) has developed a general conceptual framework of the sequence which is comprised of three major phases: OPEN , TEACH, and CLOSE. Each phase serves as an acronym encompassing 14 individual elements of teaching as indicated in Table 1.

Table 1. The Teaching Sequence

O	Objective	State clearly what you are going to do and what you expect of the learners.
P	Personalize	Connect the lesson to the students' experiences: past, present and future.
E	Engage	Involve the student in a relevant activity and/or via probe questions.
N	Novelty	Employ something new and original to increase/stimulate interest.

T	Teach	Explain, define, model, elucidate, embroider, focus attention on the critical elements, provide examples
E	Enquire	Employ questioning to confirm the students' understanding of the topic.
A	Activity	Link activities to the stated objective.
C	Check	Assess the students' progress: clarify, challenge and compliment.
H	Help	Assist the students where needed.

C	Consolidate	Concisely convey the critical components of the learning.
L	Link	Connect what was learned to the students' past, present and/or future learning.
O	Objective	Relate the learning to the particulars of the stated objective.
S	Stimulate	Establish interest in the next stage/phase of learning.
E	End	Leave the students on a positive/enthusiastic note.

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Employing this conceptual framework, instructors have been able to "place" the Internet component into a specific location in the teaching sequence to enhance learning. For example, a Web site containing extensive information on the Vietnam War Memorial was employed in the OPEN phase of a lecture to engage the students in the topic, as well as to personalize the war by finding names of those who were tragically killed in Vietnam and who were residents of the same towns as the students in the course.

An additional site was used for the activity in the TEACH phase of the model. Students working in teams went to a Web site and investigated the social, cultural and political events that were occurring at the same time the war was being fought. The students used the date of the death of a hometown soldier to determine the time frame of their particular investigation.

Last, as a part of the CLOSE phase, the students solicited a rubbing of the individual's name from the wall by using another Web site. This rubbing served three purposes: 1) as a link to the "past learning" of the lecture; 2) as a reaffirmation of the objective to "personalize the war;" and 3) as a way to stimulate interest in the next lecture of the course. In each phase--OPEN, TEACH and CLOSE--the instructor was in control and could assess the impact of the technology on the students' learning.

EFFECTIVE STRATEGIES FOR CLASSES

What are some effective strategies that will facilitate the incorporation of technology in classes? In order to successfully introduce technology into a course, the following five strategies are recommended. However, there are two qualifiers to these recommendations. First, they incorporate a philosophical-pedagogical perspective of how students should be treated and how they learn. Second, the specific recommendations may be modified as the students' technological sophistication changes.

Strategy 1. The most important strategy is framing the expectations for the technology side of the course. This should be accomplished at the first class. Students need a good rationale for learning something new. Relevant to the specific discipline, explain why the technological expectations are germane to the course. For example, there are at least four major goals for using technology in a large introductory class of preservice teacher education majors:
1) to increase learning; 2) to provide preservice professionals with a positive introduction to technology; 3) to increase opportunities for feedback to and from students; and
4) to determine the most effective ways to train teachers.

Strategy 2. Although a recent survey (USA Today, 1997) reported that 92% of college students have access to computers and use e-mail as "effortlessly as picking up a phone," in reality, *your mileage may vary*. As a part of the expectations, the instructor needs to insure that appropriate training is available to the students in a timely manner. Most institutions provide regular training in computer labs for students. Depending on the size of the class, the instructor may need to offer some additional training sessions. As a rule of thumb, 200 students should be "trained" in the necessary skills within the first two weeks of the course.

Strategy 3. The "newness" of the technology and the differing demands on the learner necessitate that there are ample opportunities and a variety of means for students to provide feedback and seek assistance. Feedback can be obtained via e-mail, daily or quarterly course evaluations, suggestion boxes, chat rooms and newsgroups, as well as regularly scheduled office hours. ***If the intent of using technology is to improve the learning in the course, be sure that it is not the technology that distracts or inhibits the learning in the course.***

Strategy 4. Whether it is through the training provided or within the course itself, there are several guidelines that students will need to be made aware of if they are to have a positive experience with technology. The first of these is "netiquette": How you communicate with protocol and courtesy on the Internet and with e-mail. Each semester there is a need to emphasize that "ALL CAPS MEANS YOU'RE SHOUTING!"

Second, warn students of the dangers inherent in the Internet. For example, never give out your first *and* last name, address, home phone, social security number or password.

Third, stress the uncensored nature of the Internet--it is at the same time one of its strengths as well as one of its liabilities. A Web site potentially can contain material that ranges from classical literature to gutter smut.

Fourth, provide exercises for students to evaluate Web sites, send e-mail attachments, join professionally relevant listservs, and read and critique electronic journals. Communicate regularly through the Internet to the class. Post announcements, the syllabus, assignments, evaluation procedures for the course, Frequently Asked Questions (FAQ's), etc. on the Web site for the class. Assign students to small groups (n=7) and give specific topics related to the course content that must be completed via e-mail using attachments. Students can assist each other as peer tutors. The instructor can use filters to presort the e-mail to handle the volume of traffic.

Strategy 5. Finally, start slowly and never penalize students if they fail on the technology side of the assignment.

CONCLUSIONS

In closing, this "Journey Into Technological Integration" will require much time, resources, and a new perspective on teaching and learning. This time, The *Axemaker* has given us a new tool that will make the journey both challenging and exciting.

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Note: A Web site has been established to complement and expand the material presented in this paper. See: <http://www.ice.net/~edutech/floridaweb/>.

THE INTERNET-BASED OPERATIONS SIMULATION GAME

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INTRODUCTION

Cranfield University in the United Kingdom and Athabasca University in Canada combined resources and expertise to develop an existing "classroom" operations management simulation game. This was done in order to deliver it online to Athabasca's Executive MBA students as part of their Operations Management module. The game was also played in traditional face-to-face mode by Cranfield Masters' students from a number of science and engineering specialisms, as part of their Technology Management studies. Pre-game and post-game data were collected from both groups of students in order to evaluate differences in the learning experience and to improve understanding of the application of operations simulation teaching tools in an electronic environment.

NON-CLASSROOM EDUCATION AND SIMULATION

Distance education, or perhaps more appropriately, non classroom-based education, has changed dramatically in recent years. Conventionally, non-classroom education was understood to be characterized by a situation in which the student was physically separated from the teacher, was separated in time from the teacher and learned independent of contact with the teacher or with other students (Beaudoin, 1986, Keegan, 1986 & Moore, 1987, as quoted by Barker, Frisbie and Patrick, 1993). Distance learning was often thought to be a poor "second best" to classroom-based education (Peters, 1993), in spite of its success at enabling people who could not attend a classroom format to gain access to learning.

In recent years the application of technology has changed the nature of non classroom-based education. While physical separation is maintained, effective teacher-student interaction and student-student interactions are enabled. Athabasca University's Centre For Innovative Management supports Canada's largest Executive MBA program (680 students) through Lotus Notes--and adopts a pedagogical approach that stresses student-student interaction.

Simulation games in a classroom environment are thought to have many benefits (Thompson, Purdy and Fandt, 1997). These include the following:

> Simulations model an interdependent open system so students can better understand the real world impact of their decisions.
>
> Simulations allow students to experience behavioral processes, the teamwork that is essential in most business environments today.

> Simulations promote active learning, debate and discussion about the decisions made--this stimulates learning.
>
> Simulations develop critical and strategic thinking skills--they focus on inter-related business processes and require consideration of issues on strategic time scales.
>
> Simulations enhance personal development by putting students in realistic environments in which their personal abilities to cope and succeed are on the line.

Simulations may therefore be very beneficial in the Lotus Notes-based learning environment as applied in the Centre for Innovative Management.

BACKGROUND TO THE GAME

The game was written at Cranfield in1992 as a manufacturing management learning exercise for Master's students and for practicing managers undertaking Continuing Professional Development courses. It was designed to give an appreciation of the inter-relationship between functional areas of a manufacturing company--e.g., finance, production and marketing. Participants gain practical experience of the difficulties of cooperative decision-making within a constrained time scale.

The game is a competitive simulation exercise of a company which manufactures two industrial products. The exercise is run over a number of rounds, each representing one year's trading. A full set of financial and other management reports are used as a basis for decisions by the teams in each round, relating to purchase of materials and equipment, staffing level, production, salaries, selling prices, marketing and other expenditure. The results of their decisions are produced by the game adjudicators, using the computer simulation model which supports the exercise.

The game is interactive--i.e., the decisions of each company will have an impact on its competitors' performance as well as on its own. The game concludes with participants assessing their team's strategies and performance.

Since 1992, Cranfield staff have used the simulation as a successful management training exercise with many groups of Masters' students and industrialists in the UK and overseas. Prior to the Athabasca collaboration, the game had always been played by teams working closely together in a boardroom type environment and making decisions based on calculations and on lively face-to-face discussions/arguments.

THE ATHABASCA GAME

Sixty students played the game online, divided into six groups of ten. Students were geographically located across Canada, from Newfoundland to British Columbia, working across six time zones. Each group worked in its own database. Each database contained instructions for the conduct of the game and "headings" to locate the discussion for each of the three rounds to be played. The game was administered by Cranfield University, located in Bedfordshire, England. Lotus

Notes enabled the academic staff at Cranfield to monitor the operation of the game, receive student decisions and respond in a timely fashion. Twelve hours were allowed between submission of student decisions to Cranfield and receipt of results by students in Canada.

The game required students to first read the instructions and then set targets for their performance in the game as a whole. This was followed by three rounds of business decisions with feedback of results between rounds. Students had six days to prepare their targets and round one submissions and then three days to prepare their decisions for each of rounds two and three.

Teams were supervised by online coaches who could provide encouragement and feedback. The coaches were located in North America (Rochester, New York; Dartmouth, Nova Scotia and Winnipeg, Manitoba). Each coach was responsible for two teams.

The students entered into the spirit of the game enthusiastically. Over the twelve days of game conduct each group averaged 234 contributions to the discussion database by its members--evidence of a high level of student-student interaction.

EVALUATION

In November, 1997 three simulations ran concurrently. One online game involved six groups of ten students each from Athabasca (AU). Two classroom games ran at Cranfield (CU), each of nine or ten. A survey tool was designed so that an objective evaluation could be made of differences and similarities in the learning experience.

Participants

AU students were older (mean 41 years) than CU students (mean 27 years). Previous qualifications also varied. The most common subjects for AU students were Business or Information Technology (50%)--for CU students it was Engineering (59%). The AU students perceived their prior knowledge of all the key subject areas addressed by the four simulation to be higher than did the CU students. All rating questions used a scale of 1-7.

Knowledge Gained

For the AU students the greatest perceived gain in knowledge from the simulation exercise was in the area of Production Planning and Control, with some smaller gains in understanding of general and financial management. CU students perceived that they had gained knowledge in all the key subject areas, with greatest value added in general business management.

Aspects Of Team Working Online

AU (distance learning) and CU (classroom-based) students assessed their teamworking performance in relation to division of responsibilities, participation level, interpretation of management reports, decision making, and time management. The results were remarkably similar, suggesting that there is tremendous opportunity for successful online teamworking within a well structured framework.

Value Of The Learning Experience

Both sets of students thought that the simulation exercise had been valuable. AU students rated the learning opportunity, their increase in knowledge, and their overall enjoyment more highly. The feedback from student questionnaires was very rewarding. As an example--

> I found this Operations Simulation to be hugely valuable. I learned a considerable amount about the manufacturing sector which is completely new to me. I also found the learning process our group underwent quite fascinating. Team members possessed unique skills and expertise which they freely shared with one another. Group work using the medium of computer technology is challenging but possible with good team effort.

CONCLUSIONS AND RECOMMENDATIONS

The survey evidence suggests that the use of a simulation game in the online group environment can be of educational value. The students certainly felt that this was so. The benefits of using simulation, listed above, were transferred.

It is also interesting to note that the survey scores recorded by both teams on their own group process were very similar, suggesting that the online environment had at least not been detrimental to group interaction. This is useful to note for the application of simulation in this environment--it suggests that the level of interaction achieved in group activities online generally may be at least on a par with that achieved in face-to-face situations. It is likely that this will also be influenced by other factors, but in this case it is arguable that at least parity was achieved. Finally, the successful application of simulation gaming in an online environment opens up many other possibilities. Of particular interest might be the potential for commercial application with international corporate management teams.

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GUIDING STUDENTS IN THE RESEARCH WRITING PROCESS

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INTRODUCTION

The author's critical concern about the declining writing skills and research abilities of undergraduate and graduate students (Madden & Lawrence, 1994) in his courses led to his designing a new approach to teaching. Using and integrating metacognitive (or internal reviewing) methods (Lee, 1998; Flavell, 1976; 1985), guided facilitation and instructional protocols helped students to create more deeply reflective papers. The quality of the technical and grammatical aspects of writing, as well as the coherence and the fluidity of thought expressed in these student papers, increased dramatically once this understanding of facilitation and coordination was implemented. Multiple ways of researching topics of inquiry that were student generated and the manner in which students used alternative thinking strategies also improved (L. W. G. Johnson, 1997).

OVERALL DESCRIPTION OF THE INSTRUCTIONAL PROCESS

Syllabus/Study Guide

In order to ensure that students are aware of the expectations and the responsibilities they need to have to meet the course and instructor's requirements, a thoroughly elaborated and clearly delineated syllabus/study guide is written for the specific course being taught. Primarily, such a syllabus/study guide is written to help students contextually understand the basic course elements, which an excellent syllabus traditionally covers. For example, such a syllabus contains--to name a few of the areas-- course title, instructor's name and office hours, course description, evaluation procedures, and course calendar.

Added to the traditionally accepted areas of a syllabus are those categories in the study guide section that help students more clearly see, and more conceptually visualize as well, the learning strategies and protocols being used by the instructor in order to help students summon their best efforts and work. These areas cover the following listed concerns:

> Specific criteria for evaluating written work--provides details concerning expected quality and evaluative criteria used by the instructor in reference to technical, grammatical, and critical thinking elements of undergraduate/graduate student writing.
>
> Annotated sources for education information--provides examples of the variety of educational reference materials available to students for conducting research, such as handbooks, thesauruses, dictionaries, and encyclopedias
>
> Phase I outline (formal)
>
> Phase I outline (webbing/concept map)

Phase II outline (formal)

Phases III/IV Outline (webbing/concept map)

Sample bibliographic entries--APA style

Self–evaluation of student work form--delineates those areas of student performance, along with the respectively assigned point evaluation ranges, which the student and instructor mutually evaluate.

Web site extra hot list--Internet Web page links and addresses directly related to the course in terms of relevant work of professional and scholarly organizations, government agencies and universities.

Web site hot list--Internet Web page links and addresses suited to the course's focus of attention. For example, if it is a teacher preparation course, then the clientele being studied falls under early childhood, elementary, middle school, secondary, and post–secondary age levels.

Recommended general Web site list--Internet Web pages and links pertinent to the general domain or discipline being studied (for example, education).

How to cite information from the World Wide Web (APA style).

Recommended reading (contains a general educational bibliography).

Use of the Internet/World Wide Web

Use of the Internet/World Wide Web is employed with students at the initial phase of their research work in the course. Three to four, one–and–a–half–hour periods are reserved for instructor and students to work together in one of the university computer labs. Along with students working at computer stations, a projection unit and multiple video screens are also used to help better visually display information (Luterbach, 1998). Some of the benefits and skills utilized and attained by students are listed below:

Helps students develop technical facility and refine applied computer skills.

Students acquire experience in further exploring research ideas through multiple ways of finding more information about topics. This acquisition occurs through the use of a variety of search engines, professional chat groups, bulletin boards, listservs and related Internet links.

Students add more extensive and updated bibliographic references to their research base.

Overall and Specific Instructional Uses of Writing in Phases

The scope of writing embraces four phases of application:

Phase I. Proposal of study with identification of issue/topic/interest or concern.

Phase II. Review of key resources/references and interview(s) plus response and initial conclusions to the above areas.

Phase III. Application and connection of course theory, practices and activities to knowledge of topic investigated.

Phase IV. Summarize understanding and conclusions reached at this point in the writing process

For undergraduates, the minimum amount of pages required for all phases is 20, while graduate students are expected to write a minimum of 30 pages. The result of the above–listed phases on the quality of student reflection, applied study and writing is dramatic--especially since these phases are assigned due dates throughout the semester. As opposed to merely assigning a final paper that is required at the end of the semester, procrastination in accomplishing this task is thus limited. Attendant with these four due dates are conferencing with the instructor in order to help students and to better appraise their progress.

Detailed outlines for each phase are included in the syllabus/study guide and are formatted in two distinct ways for students to understand the variety of conceptual tasks they need to meet. One outline style is given in the traditional manner while the second is presented through mind mapping (Buzan & Buzan, 1996; Kowitz, 1998; Margulies, 1991).

Encouragement and motivational support to students are also given by the instructor through in–class discussion, telephone and e–mail communications. Each phase of writing is reviewed by the instructor to provide detailed editing and review notes on student papers. A single–spaced, one–page critique also accompanies the return of these papers to students in order for them to see the specific areas of writing in which they are strong and for students to address those areas in their writing that need strengthening. Technical writing, grammatical expression and quality of thought expressed in their written narratives also are discussed with them in these critiques.

IMPLICATIONS ABOUT THE NATURE OF WRITING BEING WORKS–IN–PROGRESS

As up to two drafts per each phase can be written before a grade is assigned, the negative effects of initially receiving poor work is avoided. This evaluative strategy is beneficial in at least several ways as it actively supports students' ability to explore matters of style, helps them in developing their narrative and reflective powers and allows them to see a concrete evolution of their conceptual journey. The end product--their final paper in its four-phased written form--is a product about which they can be proud. It represents evidence of refined and in–depth development of their commitment to learning and intellectual activity.

Further, this work also permits students to see that enlightened opinion is one which continues to mature and that research writing is an activity that is not closed, but open–ended. The creation of a sustained effort of study, in this way originates from students' interests (J. Johnson, 1997) and ignites their imaginative (Whitehead, 1967) and critical thinking capacities. Of equal significance, this form of phased reflection and practice hopefully connects their passion for knowledge and life with their desire and commitment to studying topics that are meaningful to them and to the professions for which they are entering.

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WEB-BASED HISTOTECHNOLOGY COURSES:

A YEAR'S PERSPECITVE

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INTRODUCTION

The Histologic Technology Program at *Florida Community College at Jacksonville* (FCCJ), established in 1990 to meet the needs of the northeast Florida community college district, continues to be the only A. S. degree program of its kind in the state. The histologic technologist is an integral part of the health care team; however, educational opportunities to become a credentialed histologic technologist in the State of Florida have not been adequate to meet the demand. The question soon became obvious: How can the FCCJ established program reach potential students in areas outside the local district in order to meet those needs?

In order to reach this larger audience of potential students throughout the State of Florida and elsewhere, the curriculum of the Associate in Science (A.S.) Histologic Technology Program at FCCJ was revised to incorporate Web-based courses for both local and distance-learning students. To accomplish this goal, the College appointed a task force to collaborate between the Resource Development Department of the College and the Histologic Technology Program on the College's North Campus.

DESCRIPTION OF THE PROJECT

A major goal of the project was to provide Web-based histologic technology courses to cover the didactic material of the curriculum while maintaining the opportunity for prospective students to meet general education requirements of the associate degree at their local community colleges. Pre-clinical laboratory skill development would be made available in concentrated lab sessions at FCCJ while clinical practicum experiences would be available at contractually arranged sites in selected geographical areas throughout the state. For potential students with histologic technology experience, credit for experience would be available.

The process of instituting the new program format has been complex. The redesign of the curriculum had to be accepted by FCCJ's Histologic Technology Advisory Committee and the curriculum revisions approved by the College. Approval to offer the program outside the FCCJ district had to be acquired from the Florida State Board of Community Colleges. All of these steps have now been satisfactorily completed.

In addition, however, the program still must be approved by the Florida Board of Clinical Laboratory Personnel and the National Accrediting Agency for Clinical Laboratory Sciences, as well as the Southern Association for Colleges and Schools. These hurdles are in the process of being overcome. However, for faculty interested in revising and offering Web-based courses or programs, all of these tasks should be considered when changing delivery mode of curriculum.

Of course, when changing delivery mode, other factors also need to be considered. These include pedagogy, communication and evaluation.

Pedagogy

Although there is obvious concern over the transition from the traditional classroom setting to Web-based learning, there are several tools available to minimize such apprehensions. A number of these tools were used in the redesign of the histotechnology courses.

To promote positive feelings about learning and to help students independently identify resources for learning while also increasing their ability to work together, a positive reinforcement approach to learning was employed. This approach emphasized the use of Web-based learning resources, inquiry and cooperative learning (Chambers & Sprecher, 1983; Danserau, 1983).

The histotechnology courses were designed to provide students engaged in learning this complex body of knowledge, many opportunities to share *found* information. This information is *found* by the student through sources available on the Web (listservs, histology sites, product catalogs, on-line journals, etc). By requiring students to share their discoveries with others in the course, they receive the positive reinforcement of having helped others to locate these information resources. The instructor in this approach then makes every effort to maintain a constant and consistent feedback to all students so that they understand the importance of their contributions.

Group projects also play a major role in the courses. These projects bring cooperative learning strategies into the Web course environment.

Communication

Mandatory orientation sessions and concentrated histologic technology laboratory courses at the College provide face-to-face interaction. It has been this program's experience that this is a critical foundation on which to build subsequent forms of communication such as e-mail, discussion forums, and chat sessions. At this time, video conferencing has not yet been introduced, but the future use of this communication mode, possibly through the use of *CU-SeeMe* (White Pine Software, 1998) is being evaluated.

The histologic technology students, with the computer keyboard as their current primary communication tool, learn to phrase written communication carefully and precisely (Major & Levenburg, 1997), a critical skill needed in the medical and research laboratory professions.

Evaluation

Evaluation tools built into the Web courses of the Histologic Technology Program cover several directions--self-evaluation, mastery learning and program evaluation. Self-evaluation, due to the self-directed learning environment inherent in this program's format, is needed for students to assess the level of self-discipline and motivation required to be successful (Major & Levenburg, 1997).

Mastery learning has been incorporated into each course with a 90 percent or greater mastery level required for each module exam. Module exams may be repeated as required to reach mastery level without penalty to student grades. Students are responding to this approach with a unique degree of confidence in its worth as they see the multiple, non-punitive opportunities for achieving the 90 percent mastery level as positive reinforcement of their learning.

Program evaluation includes indicators such as completion rate, placement rate, and credentialing success of graduating students. Program evaluation is two-way, with students given opportunities during and after program completion to provide feedback to instructors.

TECHNOLOGY REQUIREMENTS

Course Development

Web Course in a Box (Saltzberg & Polyson, 1998), a development tool to simplify the problems involved in developing Web-based courses, runs on one of FCCJ's Internet servers. It provides the shell for the Histologic Technology courses on the Web. *Web Course in a Box* allows the instructor to post course material, the syllabus, class notes and announcements on the Web with little or no knowledge of HTML (HyperText Markup Language), the code used to format Web pages. Faculty at FCCJ who wish to design and maintain on-line courses using *Web Course in a Box* may do so by establishing an account through the college's Webmaster.

In order to use *Web Course in a Box* to design course pages, faculty must have access to a computer with an Internet connection and a Web browser that supports *JavaScript* (i.e., *Netscape* 3.0 or higher or Microsoft *Internet Explorer* 4.01 or higher). The minimum equipment configuration to support that software in the PC world is generally accepted to be an IBM-compatible 486/66 PC with 12 or more megabytes of RAM and a 28.8 modem. Preferably the instructor will have a Pentium PC with 32 MB (or more) of RAM and a high-speed direct Internet connection.

The latest version of *Web Course in a Box* has a quiz module, but in order to give students the type of on-line exams required for mastery learning, a software specifically designed for testing via computer, such as *PC University* (Lehman, 1998) is recommended. This software is under testing in the histotechnology project. Faculty interested in using this approach who have accounts on Internet servers that permit them to post HTML files on the Web outside *Web Course in a Box* have the necessary tools; those who don't will need access to an Internet server in order to store on-line exams created by *PC University*. If the computer has a direct Internet connection, *PC University* may require *Windows 95* in order to successfully connect to the remote server on which tests are to be stored.

Student Access

When the Web-based Histologic Technology program was conceived, it was thought that many students would access the courses via an IBM-compatible 386 computer with 8 MB of RAM and a 14.4 modem. However, design of the histotechnology courses ultimately indicated the need to make extensive use of graphics and photographs in order to convey the desired information to the students. Fortunately, in the intervening period, prices of PCS and memory chips have dropped significantly. It is therefore hoped that students taking the course over the Web will shortly be using, at minimum, a Pentium PC (or a computer with equivalent processor speed) with 24 MB of RAM and a 28.8 modem--if not 56.6-- or cable Internet connection.

Students did not initially need to utilize *JavaScript* in order to view pages produced using *Web Course in a Box*, so the courses could be accessed via any Web browser that displayed graphics. However, the new quiz module in *Web Course in a Box* relies on *JavaScript*, so students are now required to use a *JavaScript*-compliant browser (*Netscape* 3.0

or higher or *Internet Explorer* 4.01 or higher) in order to take those quizzes. However, graded exams will be conducted using software such as *PC University*, which does not require *JavaScript*.

Multimedia

As high-end Pentium-based computers become more affordable and multimedia accessories such as the *QuickCam* digital camera become more commonplace, it is planned that the learning experience will be enhanced by real-time chat sessions with *CU-SeeMe* software and inclusion of video and audio clips in the course material. Vivo Software (1998) markets *VivoActive,* one of the most promising packages for transmission of video and audio across the Web. Vivo offers a free "player" version of its software, allowing students to access video and audio clips incorporated into the courses at little or no expense.

CONCLUSIONS

This project is still a "work in progress," with more technology features to be added as the program develops. Course CD's will soon be provided to the students for their personal multimedia reference libraries. Each step taken thus far has brought new insights into the complex process of making the transition from traditional classroom instruction to the Web environment for course delivery.

By the same token, however, each step has been received with enthusiasm by students and faculty. The Histologic Technology Distance Learning Project Task Force has also presented this project as a model for other faculty to use in developing Web-based courses (Chambers, Carter & Lewis, 1997).

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INFORMATION LITERACY–

TEACHING AND LEARNING STRATEGIES

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INTRODUCTION

This paper seeks to achieve a synthesis between the literature about the nature of information processing and the literature about how adults learn--and to apply this to the design and delivery of undergraduate education. The goals of information literacy education are to ensure that students are equipped with the skills to use and evaluate information and to achieve the transfer of these skills to problem solving in the workplace, and indeed, life itself.

Definition

Information literacy has been identified as an essential element in the development of people as lifelong learners (Candy, Crebert & O'Leary, 1994). The challenge for educators at all levels of the education and training industry is to ensure that learners have or acquire information literacy. Based on the definitions proposed by Candy, Crebert & O'Leary (1994), Doyle (1992) and Bruce (1997), the following has been adopted as a working definition. An "information literate" person is one who :

> Recognizes that information is necessary for intelligent decision-making

Frames questions in a form that enables information needs to be defined.

Identifies potential sources of information.

Uses successful search strategies to obtain information, including computer-based and other technologies.

Decodes and transforms information.

Evaluates the relevance, accuracy and quality of information.

Organizes information for practical application, including storage and retrieval in a variety of media.

Integrates new information into an existing body of knowledge.

Uses information in critical thinking and problem solving.

APPLICATIONS TO CURRICULUM AND INSTRUCTION

An information literate person has an approach to learning and to the use of information which includes an affective component which addresses the need to be proactive as a learner. This need involves a self expectancy that people will be able to search out, evaluate and process information. It also includes an awareness of the necessity for independent sources of information as a tool for systematic inquiry and the ability to construct new information from existing sources. Finally, it includes a valuing of information which includes respecting the original conception of others (hence avoidance of plagiarism) and a sense of the impact and purpose of the use of information as a tool of social control or influence.

These constructs are compatible with the notion of an educated person, which is surely one of the goals of higher education. It follows that the delivery of undergraduate education should overtly seek to develop information literacy as a generic outcome, irrespective of the content focus of a particular course. It should be acknowledged, however, that the notion of generic competency is disputed by some and the implementation of strategies to achieve such outcomes are resisted by others as are any changes to established notions of practice and autonomy in college or university teaching.

Learning Generic Skills

It seems that while there is little dispute about the need to access, evaluate and use information, there is considerable debate about how information literacy should be taught and whether or not the skills are generic and can be transferred across disciplines. This debate appears common to all generic competencies. The seminal work by Lave and Wenger (1991) has been interpreted by some as establishing that all learning is context and situation specific and that generalization or transfer to other situations can not be established empirically. This is used to discount the value of general education and to argue for the advantage of workplace learning over institutional learning.

Somewhat paradoxically, the claim that learning is situated in specific social and contextual settings is itself generalized to all learning outcomes on the evidence of specific examples where learning has been shown not able to be generalized. There is, however, considerable evidence to show that in some circumstances learning is transferable. The degree of transfer has been shown to be related to the degree to which the tasks share common cognitive elements, but also is dependent on aspects of the way the initial learning occurs. In particular, transfer appears to depend on the extent to which the initial training includes a focus on generalized features of the task and on the amount and diversity of the practice provided to learners (Anderson, Reder & Simon, 1996).

The conclusions to be drawn for teaching and learning information literacy are that students need to have exposure to information literacy across a wide range of subject disciplines and that teachers need to overtly identify and reinforce the information literacy strategies which learners have employed. Therefore, formal induction sessions in library practice are of little value unless reinforced repeatedly in academic teaching practices. A difficulty faced in ensuring that such practice is provided, is the need for academics to develop and maintain their own information literacy in the face of technological developments that have transformed the available tools for accessing, processing, summarizing and managing information.

Transfer of Learning

Gick and Holyoak (1987) report that the opportunity to learn appropriate rules, based on features in examples that are structurally related to the rules, enhances transfer of training. The development of appropriate rules and hence the capacity to make transfer increases with the number of examples of applications of the rules. Optimum generalization or transfer will depend not only on the sheer number of examples provided, but also on the representativeness of the examples in relation to the situations or categories of tasks to which transfer is sought.

Several studies have demonstrated that exposure to relatively variable training instances will facilitate subsequent transfer to novel instances, even where there is a high distortion from the face or surface level of the original task. However, it has been shown that the above can be at a cost to the efficiency of the initial learning of the specific tasks that are the immediate focus of training (Fried & Holyoak, 1984; Homa & Vosburgh, 1976). The order in which such tasks are presented can mitigate against this loss of efficiency. If examples which involve low variability from the initial concept are presented first and followed with instances drawn from a wider range of contexts, then the performance on core tasks can be nearly as efficient with the high variability group as would be the case with subjects involved with only low variability in the training material. At the same time, the high variability group can demonstrate transfer of learning to novel situations, whereas the low variability learning group is largely unsuccessful in transferring knowledge to novel situations.

The conclusion to be drawn from the foregoing is that in undergraduate education, concepts need to be introduced in the initial studies and reinforced in low variability examples. Then, in higher and subsequent years of study, a wider range of contexts can be introduced without loss of efficiency of learning.

In a University setting the focus should be on training for transfer, since the purpose of a university degree is the ability to apply knowledge across novel situations. This means therefore that training in the areas such as information literacy needs to be undertaken across several units or area of study so that exposure to high variation in task can be achieved.

Gick and Holyoak (1987) report a wide range of evidence that indicates that a similarity of goals and processing between the training and transfer tasks is important in enabling transfer. This implies that in structuring tasks, especially initial tasks, one of the goals of the task needs to be the acquiring of the capacity to perform information literacy tasks *per se*. Thus, in setting assignments, an element of the assignment should be a reflection on the efficiency or effectiveness of the literacy activities rather than simply the specific use of the activity in a specific situation. This fosters thinking about the information literacy techniques, which then encourages retention of the strategy, rather than the specific tasks used in a specific information literacy procedure.

In subsequent learning tasks it is appropriate to highlight the relevance of the strategy utilized in the prior task. This facilitates transfer of the information literacy skill to the new setting and encourages the participant to develop the strategy of searching for techniques for use in subsequent novel situations.

Gick and Holyoak (1987) argue that research on the development of expertise, especially in technical fields, indicates that experts shift their bases for categorizing problems from relatively surface attributes to abstract structural attributes. In this way they are able to cue principles relevant to the solution that can be transferred or applied to the new setting. They cite Chi (Chi, et. al., 1981) and Larkin (Larkin, et. Al., 1980), in support of these claims. It follows, therefore, that in developing undergraduate education with an aim of developing professionals with expertise, it is necessary to highlight the abstract attribute involved in applying information literacy skills. This is necessary so that the techniques can be recalled in novel contexts and so that the learner can become or begin to acquire the capacities of an expert in problem solving.

Current Practice

The model for the teaching of information literacy skills has been the *user education* classes run by the library for individual lecturers, typically at the start of their first semester. Some disadvantages of this model are:

> At the beginning of the year new students are overloaded with new skills they need to learn.
>
> Some students get repeat classes in each first year subject.
>
> Classes are aimed at teaching an information skill, not reflection on the process.
>
> Lecturers often approach the library class as an "add on" to the subject without integrating the skills into the content or assessment of the subject.
>
> Classes do not cater to students of different backgrounds or levels of expertise in information seeking skills.

Daragan and Stevens (1996) comment on the lack of student interest in information and suggest that first year students seem "reluctant to actively participate in their own development". Lecturers often do not consider that students need help attaining information literacy. Based on their own experience they believe that students can become skilled on their own.

Profile Assessment

It is problematic whether an additive approach to assessment is ever appropriate in higher education studies, but is especially inappropriate when outcomes from a unit of study are not all reflecting a single dimension of skills. A simple example is the situation where theory and practice are required. Most people will recognize that a person may understand the theory but still be inept in performance.

If information literacy skills are to be fostered, it is essential that course credit be provided for achieving these outcomes. Therefore, assessment strategies are required that will give credit for achieving information literacy.

Profile assessment is a method that clusters competencies into domains, and requires competency in each domain to be assessed (Hager, Athanasou & Goczi, 1994). This approach has been identified as the appropriate curriculum strategy to achieve a cross-curriculum implementation of generic skills such as information literacy (Catts & Appleton, 1997).

Many academics are familiar with the process of marking a piece of work for "scholarship" as well as for application of principles of content. Profile assessment requires a separate assessment of each outcome to ensure that the student is competent in each learning domain. By requiring students to demonstrate their use of information literacy skills as an outcome and using profile assessment for one or more units in a course, attainment of these outcomes becomes essential for graduation.

Teaching strategies

Information literacy skills go beyond merely locating and using resources--they incorporate skills to critically analyze and evaluate information. Increased access to vast amounts of information requires services that center on seeking meaning rather than merely on locating sources. (Kuhlthau, 1993).

Educators who wish to design curricula which meet these challenges may wish to consider the strategies suggested by Lenox and Walker (1992). They suggest a fluid instructional strategy that focuses on outcomes as a dynamic process that recognizes and accommodates student diversity, that integrates the information processes across all aspects of the curriculum and that communicates an understanding of information as a commodity.

Learning strategies that do not foster information literacy include a heavy dependence upon lectures for the transmission of information. The provision of resources required by students have a heavy reliance on reading lists and/or reserve collections and fail to explicitly assess information literacy skills. (Bruce, 1992).

CONCLUSIONS

The solution proposed requires a faculty or program team to identify those generic skills required of a graduate and to implement across the whole course a commitment to each, as well as to assess the outcomes. When information literacy is agreed upon as one of the generic outcomes, it is necessary to identify opportunities for students to demonstrate, develop and transfer information literacy skills within various content units of the course.

Advantages of this course-wide approach include the opportunity to spread the responsibility for developing generic skills across units rather than running the risk of impairing the time for content studies in one unit. It also maximizes the likelihood that specific information literacy experiences can be introduced at a time when they are seen by the student as particularly relevant. Finally, the revisiting of the information literacy competencies is consistent with the theories of how generic skills are developed and how skills are taught in a manner that supports transfer to novel situations.

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BIOLOGY ON-LINE:

AN ISSUES ORIENTED APPROACH

FOR GENERAL EDUCATION

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INTRODUCTION

Scientific Literacy

The National Science Foundation conducted a survey of scientific literacy in the United States by measuring the level of understanding of scientific approach, scientific constructs, and science policy issues. The survey tested for a minimal level of understanding (knowledge that would enable a citizen to make educated choices regarding science policy issues). Only 7% of the individuals surveyed were scientifically literate at a minimal level (Miller, 1983).

As a result of these findings a major shift in the focus of general education has occurred over the past decade. The goal--to maximize scientific literacy of citizens of the United States. Project 2061 from the American Association for the Advancement of Science (AAAS, 1990; 1993) and the National Science Education Standards (National Academy of Science; 1996) are earnest attempts to increase awareness of scientific literacy. As society and commerce continue to embrace technology to drive the economy and solve social problems, more and more science policy issues have become part of the public discourse (Clinton and Gore, 1994). In any given week, science issues make headlines and fuel public debate (e.g. forensic use of DNA, cloning of mammals, AIDS, etc.). Understanding science policy issues and being able to make intelligent decisions based on the best information available is, and will continue to be, critical in this country (Bazler & Charles, 1993).

The key to enhancing scientific literacy is seen by many as occurring through science general education (Hazen & Trefil, 1991). In early grades, children exhibit a natural curiosity for science. Most teachers at these grade levels get their highest level of science instruction from undergraduate general education courses. They then use this knowledge to provide beginning science education to the next generation. Our best educated citizens also obtain their highest level of science instruction from undergraduate general education courses.

In the past, science education was designed to provide future scientists with foundation information (knowledge) and training (skills). The goals of training future scientists are very different from those of providing basic science education to an education or business major. In the former, a firm foundation must be built so that the student can move to the next level, finally obtaining the knowledge and skills required for his or her profession. In the latter, the course should be a capstone experience because it is likely the last science course the student will take . The emphasis for non-majors needs to be on concepts and issues that apply to their lives, rather than memorization of facts.

New Technology to Enhance Learning in Distance Education

A significant and growing number of students obtain their science general education courses through distance education. However, traditional distance education in science has relied on video presentation--a 1950s technology of talking heads and factual recall of material. Rarely are active, authentic, and collaborative learning used in traditional text and video-based distance education. Thus the approach tends toward memorization to the detriment of higher levels of learning that require synthesis, conceptual frameworks, and critical evaluation (i.e. higher levels of Bloom's Taxonomy; Bloom and Krathwohl, 1956).

Technology, if used wisely by educational professionals, can be a powerful tool in assisting student learning (Milliron, 1997). Technological enhancements in education can have their greatest impact in the area of distance education. Alternate modes of delivery can provide students with a wide variety of tools for high level learning, and therefore, a rich learning experience.

THE ST. PETERSBURG JC COURSE

Faculty from St. Petersburg Junior College developed an on-line section of a discussion-based biology course (Conley et al., 1997). The content of the course focuses on biological concepts and issues that are relevant to the student and society. These concepts and issues have been outlined in a number of documents that have had broad input and agreement from the scientific community (AAAS, 1990; 1993; National Academy of Science; 1996). The course uses a textbook, course Web site, activities on the Internet, and online discussions as tools for student learning. The design of the online section was attentive to the use of technology to enhance learning by using tools that assist students to achieve higher level learning (Bloom and Krathwohl, 1956). The World Wide Web and other Internet-based technologies offer a variety of these resources. The resources tap into the power of visualization (Salomon et al., 1991; Rieber, 1995) , activities, games, role-playing (Bonwell & Eison, 1991; Rieber, 1996), and authentic and collaborative learning through on-line discussions (Collins, 1996). These technologies and resources can also facilitate a higher level of learning and comprehension (Salomon et al., 1991).

Theoretical and Research Bases for the Course

The current mechanisms used to develop learning in our schools discourages the natural (inherent) ability of students to think symbolically in pictures and diagrams rather than words (Rieber, 1995). Yet many students are visual learners. Complex ideas are often perceived in visual, and usually simplistic, ways. The abstract nature of verbal descriptions cannot do justice to the visual. For example--transcription and translation of DNA are critical concepts in any college level biology course. When a student understands this process, it provides a bridge to understanding human physiology, genetic nature of disease, immune response, and other important health issues. It is, nonetheless, difficult to explain in a step by step fashion using only verbal communication. However, simple animation of the process makes the concept of protein construction (from DNA) much more readily understandable.

A strong body of research reveals significant increases in comprehension when students become actively involved in the process of learning (Bonwell & Eison, 1991). Traditional methods of distance education are passive and do not provide opportunities for active learning. Many students also learn well through activities that require interaction with the computer (Rieber, 1996). Researchers and developers are struggling to find innovative ways to exploit the interactive potential of the learning environment afforded by computers while remaining consistent with psychological and philosophical beliefs about how people learn (Hannafin, 1992; Hannafin & Rieber, 1989a; 1989b).

Quality visualization and active learning exercises in biology on the Internet number in the hundreds. *Cells Alive* is one of the most frequently cited Websites for quality of presentation (Sullivan, 1998). Through this site students can access a variety of animations and still images that reinforce the concepts of rapid cell growth, relative size and impact of cells on human health.

Faculty and staff from the University of Arizona have developed a high quality Web site, *The Biology Project*, with a wide variety of animations, images and tutorials with an emphasis on cells and molecular biology and their impact on humans (Goss et al., 1997). *The Biology Project* also contains a number of resources for student activities and group projects. Among the best active learning materials for biology on the Web are sites that allow manipulation of traits so that students can explore the results of a variety of test crosses to understand patterns of inheritance (Desharnais, 1996; Sofer & Gribbin, 1997). When guided by faculty, these distance education options can provide many of the learning benefits of a traditional science laboratory.

The Biology Place (Campbell et al., 1998), a collaborative effort of 15 authors and a team of Web developers, is an award winning Web resource that includes material for visualization, active, and collaborative learning. Among the features are study guides of specific concepts with animations and interactive self-assessment tools and investigative projects of a particular research area (that may include data collection from other Web sites). Also included are laboratory investigations in which students conduct experiments and learn experimental design and collaborative research where students participate in investigative or experimental activities and share results with other students.

Textbooks, Collaborative Learning and the Web

Textbooks. The textbook and other written resources play a critical role in any college level course and are especially important in distance education. In absence of a lecture, the text becomes the principle provider of content knowledge. *Biology Today: An Issues Approach* (Minkoff and Baker, 1996) is a nontraditional college text designed for the non-major. Authentic learning is enhancing comprehension by placing an emphasis on the connections between the topic and the learner (Collins, 1996). The authors of this textbook embraced the concept of authentic learning by making connections between biology and social issues in both the content coverage and chapter thought questions.

Collaborative Learning. Collaborative learning through group work is also an effective pedagogical tool that enhances the development of higher order thinking (Cohen, 1994; Lebow and Wager, 1996). Listservs and threaded discussions can provide the vehicle for discussion and collaborative activities. Both have their strengths and weaknesses.

Listservs are similar to group e-mail. A message sent to the list is received by all subscribers (i.e. the class). The advantage of a listserv is that it is a forced discussion. Any student viewing his or her e-mail would have to choose to ignore the messages. The disadvantage is that it is not structured. If class size is large, the messages get jumbled and students can easily become lost. It is difficult for the instructor to keep track of who is saying what to whom.

Threaded discussions, on the other hand, are highly organized, with an outline format. But the student must make the effort of going to the Website, reading messages from the instructor(s) and other students and then compose his or her response. It requires more discipline on the part of the student.

Another advantage of threaded discussion is the ability to assign and organize student research projects (Ortez, 1994). Students can be divided into groups and assigned a problem or question that requires research using the Web. The students can use the discussion page as a forum for sharing ideas and data. Regardless of format, discussion forums can provide all of the advantages of collaborative learning without the physical presence of the student, thus facilitating higher level learning.

CONCLUSIONS

In summary, college science general education courses are a key to enhancing scientific literacy in the United States. A significant and growing number of students take their general education courses through distance education. Traditional textbook and video delivery of information do not provide the best learning environment for many, if not most, students. Technological advances over the past five years, especially over the World Wide Web, offer instructors a number of tools that can be employed to enhance learning in distance education courses.

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USING PROBLEM-BASED LEARNING IN THE LITERATURE CLASSROOM

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INTRODUCTION

Problem-Based Learning (PBL) is a student-centered method of teaching that was developed in the 60's and 70's in the McMaster University Medical school to better prepare medical students for the decision making that is a necessary part of being a physician (Aspy, Aspy & Quinby, 1993). Rather than creating a teacher-centered experience, Problem-Based Learning places most of the impetus of learning on the student. According to Barrows (1984), Problem-Based Learning involves discovering the needs of the learning process in a group setting--then solving a problem provided by the instructor. The most significant aspect of this method is that through problem solving, the student groups identify and locate the knowledge they need (Ross, 1991).

PBL emphasizes problem-solving skills as well as acquiring the desired knowledge base of the content course through a group solution to a highly structured problem provided by the instructor. (Tanner, Keedy and Galis, 1995). A problem-based class usually involves the following characteristics (Savoie & Hughes, 1994):

1. Begin with a problem

2. Ensure that the problem connects with the students' world.

3. Organize the subject matter around the problem, not around the disciplines.

4. Give students the major responsibility for shaping and directing their own learning.

5. Use small teams as the context for most learning.

6. Require students to demonstrate what they have learned through a product or a performance.

CREATING A LITERATURE PROBLEM

There are three types of problems that can be used in a literature classroom. Illustrations are provided below which should help to clarify the different types.

Type 1 Problems. The first type places students in a given cultural, social or political situation. These problems can be given to students to help them understand the reality that an individual author is coping with in constructing his or her text. They require very little textual knowledge on the part of the students. As a matter of fact, they might even be constructed so that the students are unaware of the connection between their activity and the assigned reading. As an example, when discussing Ann Petry's *The Street* (Petry, 1946), the discussion of the text might begin with the following problem:

> On a Sunday morning edition of *Meet The Press*, representatives of the National Organization of Women, the NAACP and the American Socialist Party are discussing the myriad of obstacles that individuals face based on their gender, race and class. The producers of the program ask you to give a final editorial comment on which of these issues is the most

> difficult to overcome. *Which do you choose? What reasons do you have for your decision?*

After giving the students 10 minutes to write out their own responses, have them break up into three groups based on the decision they reached and share responses. Then have the groups discuss their findings. The problem and the ensuing debate introduces students to the overlapping implication of race, gender and class that plays such a key role in Petry's novel.

Problem Type 2. The second type of problem requires students to be more familiar with the text. For this activity the characters and events of the text are placed into a real world situation and the students are asked to deal with the novel as non-fictional text. This example can be used after students have finished reading the first two books of Richard Wright's *Native Son* (Wright, 1940).

> You have just begun working at a center for emotionally troubled teenagers. As a counselor, you will be seeing young men and women from a variety of backgrounds and a variety of emotional problems. Your first patient is a young man who has recently been arrested for a series of violent crimes. His name is Bigger Thomas.
>
> Before your meeting with him, you are given two written reports on Bigger's behavior. The first is a report of his life before the crime spree (Book I). The second was written after his arrest (Book II). *What differences do you see in Bigger's behavior between these two reports? How has his view of his crime changed? To what do you attribute these changes?*

By completing the problem, students develop opinions on several of the key issues of Wright's text while also developing some compassion for a character that most young readers find difficult to appreciate.

Problem Type 3. The third type of problem is to create real world literary problems. Faculty can use problems that develop from their own instructional situations (Aspy, Aspy & Quinby, 1993) to create situations in which students are developing the skills and strategies required in literary study.

For example, one skill that literary students should acquire is the ability to form connections from any given text to both the work that was done prior to it and what followed. They should also be able to form connections between the text and the world that existed during the creation of the work.

The following problem is one that can be used with more advanced students and could effectively lead to several weeks' worth of class. This problem was developed for students in a Literary Studies Class who were working with works of early Twentieth Century American Literature. The text in question is Ernest Hemingway's *Big, Two Hearted River*.

> While going through your grandparents' attic, you find an old metal chest. Upon opening it, you discover a handwritten manuscript that, though yellowed and brittle, is still readable. You don't know who wrote it, or why your Grandfather had it. After reading it, you are impressed with its style and imagery. Perhaps this is a lost masterpiece? Or perhaps your Grandfather was a hidden literary genius?
>
> You ask your Grandmother about it, and she doesn't remember the story, but she recalls your Grandfather bringing the box home from

> Spain after having served as an ambulance driver in WWI. You decide to investigate the potential value of this story. *Who wrote it? What was he trying to say? How does it connect with what is generally called classic literature?*

From this point have the students generate a list of questions they would have about the story and the limited knowledge they have about its creation. Then, break them into groups to discuss the possibilities. Some areas that might become issues include: Hemingway's biography, WWI, Modernism, Hemingway's peers, the realists who proceeded him, fishing as metaphor, minimalist , etc. The students would be spending a great deal of time in research and reading, and it would remain the Professor's task to fill in the gaps with lectures and examples and lead the frustrated and lost.

BENEFITS OF PROBLEM-BASED LEARNING IN A LITERATURE CLASS

There are many reasons to incorporate this teaching method into a literature classroom, but the primary benefits are the increased interest that PBL can create in the average Literature student. Many young readers are uncomfortable entering into a literary discussion, particularly with a professor who they expect to provide them with the *right* answer. By providing students with a stance to take that is more familiar to them they can bring information to the problem that they never knew was of literary value.

As an illustration, in the second example, students are able to bring in knowledge of counseling, psychiatry, sociology etc., thus probably making them feel more comfortable. PBL is also useful for students to discuss issues that are uncomfortable for them, such as race and gender. By taking a position outside of themselves, such as a counselor or journalist, they seem to be more comfortable discussing issues they would have trouble with if the thought were connected to them as individuals.

CONCLUSIONS

PBL appears to be useful to get students beyond the idea that literary knowledge is something for them to absorb. Rather, when they are coerced to do the work themselves and form consensus among a group of students, they seem to grow more comfortable with dealing with literature as an extension of culture, society and even of themselves.

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CREATING AND MAINTAINING COURSE HOME PAGES–AN EFFECTIVE WAY TO USE THE WEB TO ENHANCE THE CLASSROOM

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INTRODUCTION

The use of the World Wide Web has dramatically changed the way people gather information, the way people communicate, and the way people live. Vast quantities of data can be obtained in seconds simply by clicking on a few keys. Having this new technology so readily available can be an asset to the preservice and inservice teachers of mathematics (of course--of any other subject as well), but at the same time it can be overwhelming. Although there are large amounts of information available, there are so many places to go.

Many Web sites are helpful. They are interactive with problems for students to explore or they contain thoughtful ideas of reform mathematics. Some sites, however, are merely information for the curious or even information of little value. Browsing the Web can be a delightful experience, but it does not come easy, even for computer-literate teachers. One of the authors' students, a high school teacher stated:

> In my browsing I discovered that I would find a site that would link to another site and to another and so on. I had so many choices that interested me, but I could only choose one at a time. When I was ready to go back to

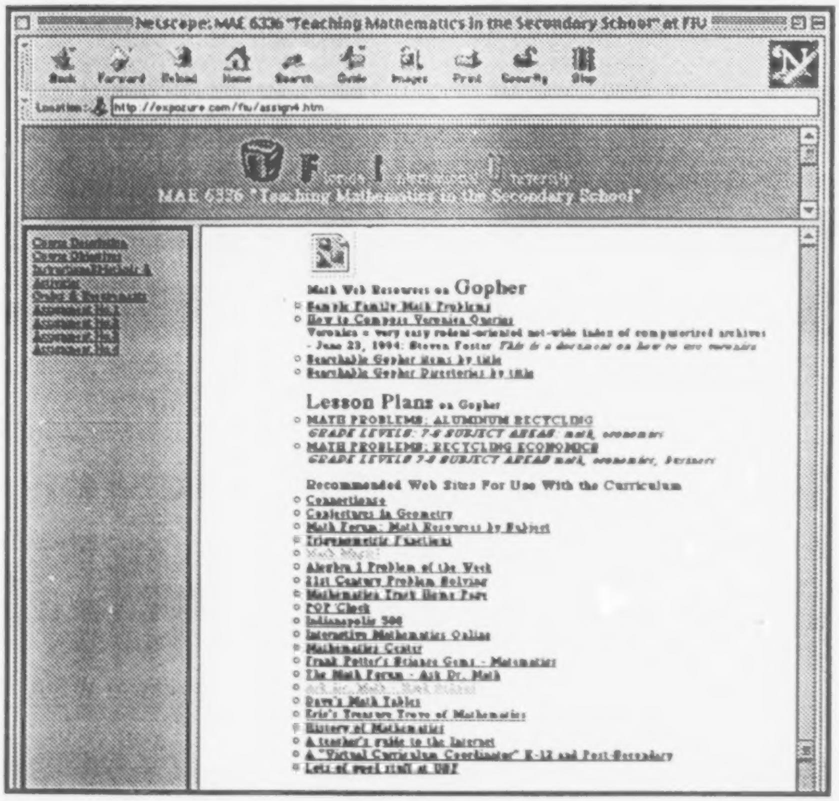
> another site that I had previously seen, I could not find it again.

One of the realizations about the use of Web technology is the amount of time that people spend on it. Those minutes spent browsing suddenly add up to hours. This is especially true for new users of computers. Many teachers who are willing to try using the Web become frustrated at the amount of time they spend searching for the appropriate sites that will help with their lessons. If this process takes longer than their previous planning time, then they are likely to feel it is not worth the extra effort to use the Web. To confront and try to deal effectively with this problem, this article will discuss ways to more easily create and maintain effective course Home Pages for mathematics teacher educators. Other references on this topic are provided by Abkemeier (1997) and Beasley (1996).

PROVIDING QUICK AND CONVENIENT WAYS TO FIND USEFUL RESOURCES

The most significant feature of a well-designed course Home Page is that it overcomes the time-consuming difficulty mentioned above, and provides quick and convenient ways for students to find and use the most helpful and relevant resources. Another important feature is that it is constantly updated to provide the latest information. These can be done by carefully choosing the best Web sites in the field of mathematics education that are closely related to the course objectives and by making links for students to bring up these sites at any time when they have the needs. MAE 6336 (Teaching Mathematics in the Secondary School) is the methods course that one of the authors offers to his graduate students, most of whom are inservice teachers. The Web page designed through the common efforts of the students and the instructor for this course has made the links which are displayed as text in Figure 1.

Figure 1. Links To Bring Up Relevant Resources



Netscape: MAE 6336 "Teaching Mathematics in the Secondary School" at FIU

http://expozure.com/fiu/assign4.htm

Florida International University
MAE 6336 "Teaching Mathematics in the Secondary School"

Course Description
Course Objectives
Instructional Methods & Activities
Grades & Requirements
Assignment No.1
Assignment No.2
Assignment No.3
Assignment No.4

Math Web Resources on Gopher

- Sample Family Math Problems
- How to Compose Veronica Queries
  Veronica = very easy rodent-oriented net-wide index of computerized archives - June 23, 1994: Steven Foster *This is a document on how to use veronica*
- Searchable Gopher Items by title
- Searchable Gopher Directories by title

Lesson Plans on Gopher

- MATH PROBLEMS: ALUMINUM RECYCLING
  GRADE LEVELS: 7-8 SUBJECT AREAS: math, economics
- MATH PROBLEMS: RECYCLING ECONOMICS
  GRADE LEVELS 7-8 SUBJECT AREAS math, economics, business

Recommended Web Sites For Use With the Curriculum

- Connections
- Conjectures in Geometry
- Math Forum: Math Resources by Subject
- Trigonometric Functions
- Math Magic!
- Algebra I Problem of the Week
- 21st Century Problem Solving
- Mathematics Track Home Page
- POP Clock
- Indianapolis 500
- Interactive Mathematics Online
- Mathematics Center
- Frank Potter's Science Gems - Mathematics
- The Math Forum - Ask Dr. Math
- [illegible]
- Dave's Math Tables
- Eric's Treasure Trove of Mathematics
- History of Mathematics
- A teacher's guide to the Internet
- A "Virtual Curriculum Coordinator" K-12 and Post-Secondary
- Lots of good stuff at UBF

While all these linked resources are important, the instructor recommends that students visit at least such relevant sites as <http://www.nctm.org>, <http://forum.swarthmore.edu>, and <http://jwilson.coe.uga.edu>. The Web Site <http://www.nctm.org> is the Home Page of the National Council of Teachers of Mathematics (NCTM). The site makes available on-line publications like *Journal on Research in Mathematics Education* and *The Mathematics Teacher* which

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present the latest research findings and creative teaching and learning ideas. Furthermore, the site provides up-to-the-minute information on mathematics reform.

As an example, the NCTM Web site posted the *Summary of NCTM's Findings About TIMSS 12th Grade* so that the students were able to study this document--which had been released on February 27--in their March 2 class. It had been impossible to get such important and relevant information in such a timely manner prior to the introduction of the Web. This is now made easy through our course Home Page.

At the site <http://forum.swarthmore.edu>, students can participate in the exchange of ideas with mathematicians, educators, students, and others interested in mathematics and mathematics education throughout the world. For students majoring in mathematics education, <http://jwilson.coe.uga.edu> is a Web site of value. Professor James W. Wilson at the *University of Georgia* is an internationally known mathematics educator. His Home Page consists of high quality research and problem solving articles, interesting and challenging mathematical problems, innovative ideas of using technology to enhance teaching and learning and much more.

The students feel they have greatly benefited by using these Web sites in doing their course assignments/projects and in developing themselves professionally. According to their suggestions, the course Home Page will shortly be improved by organizing the links categorically. Examples of the categories include:

> Links to resources of mathematics education research and mathematics teaching and learning theories.
>
> Links to resources of mathematical problems and problem solving activities.

Links to resources of technology in teaching and learning mathematics.

Links to resources of lesson plans.

Links to resources of real world data that can be used for data collection and analysis purposes.

EFFECTIVELY ENCOURAGING STUDENTS TO USE WEB TECHNOLOGY

While most of the students recognize the importance of using Web technology in their learning and teaching of mathematics, not all do. Some students think the old textbook-handout approach to getting course information is good enough. Some, especially those who work a lot when attending college, emphasize that they do not have time to visit the Web pages because of their busy schedules. If these considerations are allowed to develop freely, then the professors are not caring for their students' learning in the information age.

To create Home Pages for the courses they are teaching and make full use of the pages is an effective way to encourage students to take advantage of Web technology. In MAE 6336, the instructor has not given handouts for some of the homework assignments, but rather has asked students to find these assignments from the course Home Page. For this request, the feedback from students has been positive.

While Web-enthusiastic students enjoy visiting the course Home Page to find the assignments, those who had initial reservations on the use of the Web did express interest in *trying* the powerful technology. They all agreed, however, that some "pressure" from the instructor was necessary. This "pressure" provides no room for excuses for not using the Web technology. When students really discover how the use of the Web can enhance their learning, they feel the "pressure" as a kind of motivation.

The authors are planning to post all information of their courses only on the course Home Pages starting next semester. No more handouts will be used, including those for the course syllabi. Students will be introduced to the Web at the first meeting of each related course. They will start "surfing" the Net at that point.

PROMOTING COMMUNICATION

In the mathematics education courses such as the methods courses for preservice and inservice teachers, the authors always find there is not sufficient time to completely accomplish all of the course objectives. Many important mathematics reform documents should be seriously studied. Thorough discussions are needed for students to achieve a sound understanding of issues such as:

> What characterize effective mathematics teaching?
>
> How can we develop ourselves so as to become effective mathematics teachers?
>
> How can we motivate our students in their mathematical learning?

To help students become capable problem solvers, the inservice and preservice teachers should first be such problem solvers themselves. This requires that they put considerable time and energy into problem-solving activities. They need to develop their ability to use technology to facilitate their own learning as well as to integrate the use of technology into their teaching. All of these require strong communication between students and their professors and among students--and all of these require time. As is well known, however, class time, plus professors' office hours, are so limited that in many cases the students and professors have to conclude discussions before a thorough analysis can be completed. With a well-designed course Home Page, this situation can be greatly improved.

First of all, students do not have to finish a discussion in class. They are encouraged (or required as a course assignment) to share the ideas that they did not get the chance to present in class with their classmates through the course Home Page so that further discussion can always be conducted if needed.

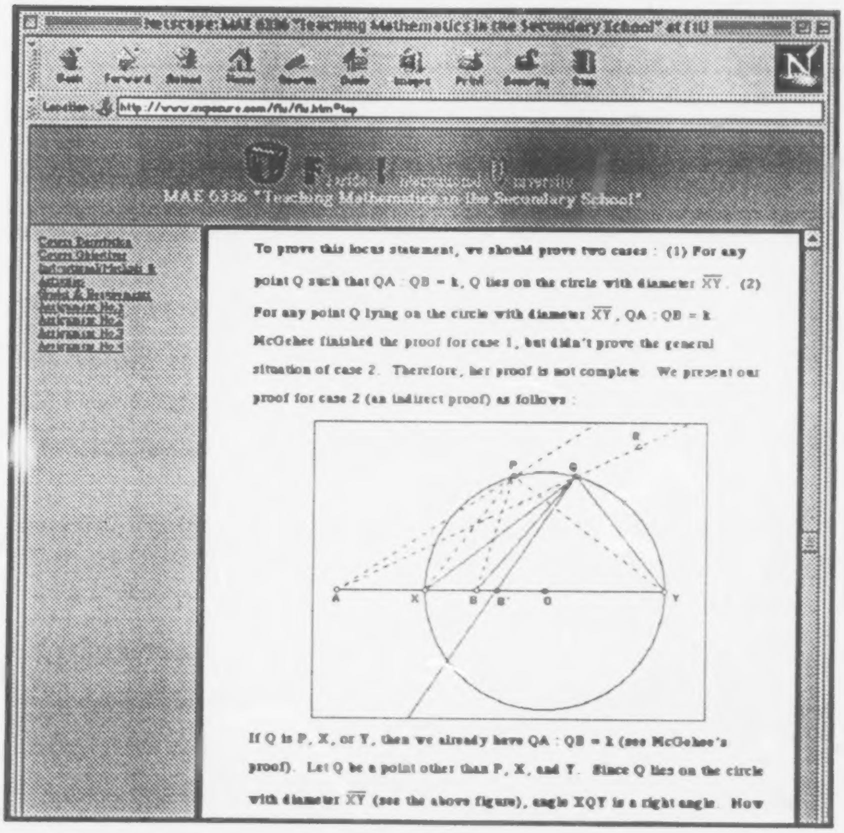
An example of using the course Home Page to promote and further a class discussion is MAE 6336 students' discussion on a problem solving article *Interactive Technology and Classic Geometry Problems* (McGehee, 1998). The students read the article in class, tried to solve the problem presented in the article in their own ways and commented on the teaching suggestions made by McGehee. For quite a while, they concentrated on the following description and McGehee's proof:

> Given any two point A and B and a point P, not on $\overline{AB}$; let PA:PB be a constant ratio k where $k \neq 1$. The locus of points in the plane with constant ratio k is the circle with diameter $\overline{XY}$ where X is the intersection of the interior-angle bisector at angle P with side AB and Y is the intersection of the exterior-angle bisector at P with line AB.

Apparently a lot of content was involved. The discussion could not be completed in class, so the instructor and the students decided to continue their discussion on the Web. The students sent their ideas via e-mail to the student responsible for posting inputs on the course Home Page. They also commented on each others' ideas in the same way. The instructor also participated in the exchange of ideas.

Figure 2 shows part of a comment to McGehee's proof. Through the in-depth discussion, the students gained a better understanding of the problem discussed. They also developed an understanding of the constructivist point of view and how interactive technology can be effectively used to help students learn mathematics. In addition, the discussion process and highlights posted on the Home Page helped those students who were unable to attend the class to "catch up".

Figure 2. Discussion Results Posted On The Course Home Page


Netscape: MAE 6336 "Teaching Mathematics in the Secondary School" at FIU
Forward
Location:
MAE 6336 "Teaching Mathematics in the Secondary School"
P
Q
R
A
X
B
B'
O
Y

To prove this locus statement, we should prove two cases : (1) For any point Q such that QA : QB = k, Q lies on the circle with diameter $\overline{XY}$. (2) For any point Q lying on the circle with diameter $\overline{XY}$, QA : QB = k. McGehee finished the proof for case 1, but didn't prove the general situation of case 2. Therefore, her proof is not complete. We present our proof for case 2 (an indirect proof) as follows :

If Q is P, X, or Y, then we already have QA : QB = k (see McGehee's proof). Let Q be a point other than P, X, and Y. Since Q lies on the circle with diameter $\overline{XY}$ (see the above figure), angle XQY is a right angle. Now

BEST COPY AVAILABLE

Of course, other things can be accomplished through use of a course Home Page in addition to furthering class discussions. Students can use the Home Page to e-mail the instructor directly in order to turn in homework assignments, comment on the course, inquire about the topics learned, share creative problem solving ideas, etc. The instructor can give quick, if not immediate, feedback (comments, clarifications, answers, grades, etc.) through e-mail or by posting the reply, with security if necessary, on the Home Page.

The security problem can be solved by creating a folder for each student and making a password a requirement for entering the folder. All grades that a student had received thus far in the class could then be posted in his or her folder. This would permit the student and the instructor to know how he or she is doing at a glance. If there is make-up work pending, the instructor and the student could have direct interaction via the folder. The instructor can also provide pertinent links dealing with each specific assignment or concept.

It would be nice, but not necessary, to have student bios and student e-mail accounts linked with Home Pages. All these would give the instructor and students more opportunities to communicate with each other.

OTHER ISSUES RELATED TO COURSE HOME PAGES

Chat Rooms. Many Internet users are aware of the features of a chat room. It basically serves as a communication tool over the computer for people at different locations. For instance, the Internet Relay Chat (IRC), a popular chat room, is used by people all over the world. Chat rooms were first created for the Unix system and then improvised for Windows and Mac OS. People now can talk directly to each other on a Web page with any computer platform. This technique has been adopted by many college professors.

By posting a chat room on a course Home Page, students and the professor can discuss course topics at the same time. This way, students don't have to attend class and can still access discussions in the classroom--albeit a virtual classroom. The use of virtual classrooms not only saves students' time from getting to class, but also motivates them to more use of technology.

The authors are thinking of ways to balance real and virtual classrooms. At present they feel it is still necessary to keep all scheduled class meetings. A chat room would be used mainly for the continuation of classroom discussions that are not completed due to limited class time.

Getting Busier? By fully utilizing a course Home Page, students and their professor have more opportunities to communicate with each other. This probably makes them busier than ever! Students may need to spend considerable time on the Home Page-oriented course activities and the professor may need to frequently sit in front of a computer to give students quick feedback.

In order to keep students' enthusiasm on the use of the Web, the professor should not only make their participation in the Home Page oriented course activities a requirement of the course but also lighten their burden by suitably assigning less homework. On the part of the professor, it is necessary to work harder (or to put in more hours) during a period of time to get the course Home Page to function well. As soon as a good structure of the course Home Page and the professor's working habits with the page are established, he or she will feel more comfortable, rather than busier, in teaching the course and seeing the progress made by the students.

CONCLUSIONS

The World Wide Web provides valuable new avenues for education. A glimpse of the opportunities it affords is beginning to emerge. Taking advantage of these opportunities, however, requires considerable effort on the part of those who participate. Using the Web is time consuming and labor intensive, if productive outcomes are to be derived. Students and faculty may find valuable resources through the Web as well as increased opportunities to keep in close communication--but at the expense of continuous effort and time consumption. Establishing a Web page for a course can help overcome the time consuming difficulty, while providing students with quick and convenient ways to find useful information. Web pages also create a much more interactive learning environment, thereby increasing the effectiveness of learning.

The immediacy of information is a valuable part of the Web. The rich resources of up-to-date information keep Web users abreast of the latest in various fields, encouraging them to become life-long learners. A well-designed course Home Page provides the balance of the real and the virtual classrooms and class sessions--which ideally makes the class a more continuous happening--rather than something that is done in one or two hours and then set aside for the remainder of the week. The advantage is that additional information, feedback and other challenges are always available. Of course, constant creation and improvement are necessary for this to be effective.

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COLLABORATIVE RESEARCH WRITING USING THE INTERNET

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INTRODUCTION

The mixture of writing and research skills in the traditional ES 102 class and the demands multiple sections of this class make on vital library text resources of a typical comprehensive university have made delivery of this course a pedagogical and logistic difficulty. Increased notice from outside assessors and employers that university graduates are unprepared for group work revealed an opportunity to resolve both problems while meeting stakeholder demand..

THE WRITING CLASS

In spring, 1997 two sections of ES 102 first employed an innovative method of writing research papers. The three person learning group model of Johnson, Johnson and Holubec (1994), modified according to the college professor role suggested by Weiner (1986) as appropriate for collaborative writing classrooms, became the method of composing and editing. Group membership was self selecting or random selected (Smith & Waller, 1997). Groups were free to devise whatever method they wished to allocate tasks. Students chose essential group roles (meeting caller, record keeper and object handler) and wrote a group contract. Each group had the task of delivering, at the end of the semester, one ten to fifteen page research paper.

The subject of the paper was the background, actions, and troops of a general officer commanding in the *Battle of*

Gettysburg. This subject came to mind as a result of the contemporary novel *Gods and Generals* (Shaara, 1996). The three day event, the large scope and the immense popularity of civil war history was enhanced by the availability of both short and comprehensive film histories of the battle.

The method of finding biographical data on the generals was the second major innovation of the course. Traditional research has always begun with a check of the encyclopedia. While not often an acceptable reference, it accomplishes a lot of things. It shows what is consensus opinion. It reveals relative importance. It leads to experts and sources. After that, *Books in Print* and the *National Union Catalog* are checked. Next comes indices and/or CD-ROM's. Then contact with sources occurs.

In this class, the Internet supplanted the encyclopedia while supplementing the catalogs. Searching conventional sources might lead to a book, but a quick visit to an Internet bookseller such as Amazon.com <http://www.Amazon.com> provided information not in the college library. One example was both the existence and availability of a book on General A.P. Hill. A name search on Yahoo! <http://www.yahoo.com> delivered a thumbnail of the general.

The great benefit of research writing using the collaborative approach was that it avoided problems identified with the Internet--trustworthiness and verifiability. The group approach was a mechanism for double checking. It required downloading to either disk or hard copy, and thus created an identifiable source.

CLASS RESULTS

Good papers were very good. The layout of some papers approached the professional. Clearly, Internet surfers know their way around the computer. The visual quality of the papers was a notable surprise. Fonts, wrap-arounds and picture/art inclusions such as downloaded maps and portraits added to the papers. Students seemed less restrained in asking questions. Perhaps, as a result of talking with each other and being equally puzzled, they found it less threatening to ask the professor. Built-in individual student tasks and a retained final to check on skills provided some grading insurance.

The greatest morale value of the Internet was in the arcana. Battle flags, military uniforms, insignia, and a range of daily life details led students to the kind of serendipitous discoveries that constitute the fruits of real research. Understanding of cause and effect relationships, often starting from simple observations, is what academic research is at its best. Freshmen were excited that they could identify such logical links.

Students discovered and shared interesting or exciting archives and dedicated Home Pages with the class. Having the Internet serve as a key to specific material in a wide pool of information minimized library strain while allowing use of the library to check documentation. This was the opposite of the stripping of the library which usually occurs.

The class required transparent structure, and the professor needed daily lesson plans. Much research was found to be possible during class time with computer and Internet access in a lab setting. Exact, written assignments directed students. An "almost" lab setting, with little class time dedicated to teacher talk, and table based groups allowed early identification and solution of participation problems. It was found that at least one group member was required to be familiar with computers.

MISSING TREES FOR THE FOREST

Implications

The initial critique of the class led to the above refinements in lesson planning, assignments and group organization for the second iteration. However, the cause of the success remained elusive apart from the self evident attraction of the Internet. An interesting thread lay in the enhanced visual quality of papers. Further speculation led to something more. The topic choice was fortuitous, for it was Internet compatible--a battle is not a linear event, it is net-like. In any battle a variety of interactive units composing the "thing" are happening synchronously. In the actual battle the flanking maneuvers at "Culp's Hill" and "Little Round Top" occurred within the same time period. Personalities, technologies and geography all interacted.

Subjects requiring in-depth analysis may not lend themselves to such treatment. Complex statistical and linear arguments are better suited to traditional forms. Research reporting compatibility mirrors research searching compatibility. Still, this may be to scholarship what the film was to the stage, or what television was to cinema. It changes everything. Traditional journals and papers may soon be competing with a new research product--a "thing".

At a recent conference in Myrtle Beach, Healy and Spodark (1998) reported on success with "Professors' Portable Pages" (essentially HTML syllabi containing links which can be disk loaded by students). Anderson, Benjamin and Paredes-Holt (1998) in their text on on-line writing suggest a product of this sort for student writing. In similar fashion, students using HTML should be able to compose an interactive research object as the result of a course. Translating software which can create HyperText "things" is available. *WORD 97* (Microsoft, 1997) has a translator built into the software. Such "things", either loaded on disks or transmitted electronically, may easily supplant the more traditional forms, especially in a highly networked and developed system.

A Beethoven project could hyperlink to themes, virtual tours, biographies, and performances. Melody lines, tempos and, ultimately, performed interpretations could be fused into the discussion. Film criticism could intersperse visual allusions, different actors, directorial and cinematographic signatures in a dazzling pastiche. The possibilities are endless. Sequential arts, (ballet, drama, opera) might be criticized and appreciated in a new interlinked way that could be internally linked or fused into the Web, or a new interactive art form might emerge. Historical controversies and conflicting points of view could focus multiple references on one moment of time or one aspect of an event.

The subject for these innovations was a crucial area of choice. Just as the generals interacted with other generals, so the different class research teams could interact. Custer's attack on Stuart's cavalry protects Doubleday's right flank, and so forth. Teams had information to share and trade. Each student could contribute information to the paper and to the class. Potentially strong subjects suggest themselves--the Kennedy years; the sixties; the Constitutional Convention; the Roaring Twenties; Post World War I Paris; Impressionist painters; the War of the Roses. The complexity of such composition and the range of references could well mean that collaboration on research and its reportage will become a necessity rather than mere enhancement.

CONCLUSIONS

Criticism of college graduates' inability to work collectively led composition programs to develop writing groups. Internet augmentation of a selected research topic for such groups' writing was found to generate improved student products with reduced paperload. Effective topic selection and instructor intervention appeared to minimize traditional research-paper problems, yet group cross-checking assures reliability.

Continuing research indicates potential for improved techniques, but more importantly reveals a new form of reporting research results, a "thing," which is both internally cross-referential and takes advantage of being hooked into the Web. It uses hyperlinks to communicate its message in a nonlinear structure. *Where will it all end?*

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ART AND HI-TECH IN PHYSICS LEARNING

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INTRODUCTION

At Virginia Commonwealth University (VCU) the commitment to improved instruction led to the development and implementation of a new general education curriculum that stressed increased science literacy. VCU's College of Humanities and Sciences set out to create new models of college level instruction and pre-service education using multidisciplinary science courses (Niculescu et. al., 1996).

In the area of physics, a new conceptual physics course aimed at non-science majors was developed entitled *Wonders of Technology* (Niculescu, 1998). The development of visual material for this course led to an exciting initiative in which 3D digital animation students from the Communication Arts and Design department worked to create highly intuitive animations. Their success blends well with continuing efforts (Art & Science Collaborations, 1997) to enhance the general awareness of art and artists using science and technology to explore new forms of creative expression--and within a broader scope--to emphasize the interdependence of science and art that has been so pervasive throughout history (Dauben, 1998).

The Interplay of Science and Art

Working with three-dimensional animation requires students to remember, or learn for the first time, some basic principles of physics and geometry. New students are apprehensive at first, assuming that they have to be 'good at' math to be successful animators. The truth is the graphic user interface (GUI) for most software is fairly intuitive and does not require programming or user computation. An understanding of the physical world is, however, helpful, as the 3D virtual environment is based on principles of the physical world.

Material properties such as transparency, reflection and refraction are applied to modeled objects. Lights are defined as to their falloff , direction and color, depending on their type. Objects are created from geometric primitives in a space that Descartes defined based on his coordinate system. Boolean logic is applied to form a new object from the intersection, difference or union of two separate objects. In the 3D environment these principles are applied as tools.

Incredibly, students still see these principles only as tools for their use and do not make the connection that they are working principles derived from the physical world. It is as if refractive properties of glass and water were created for 3D modeling applications only. Within an art and design curriculum there is limited opportunity to help them make those connections between their art and the science it evolved from. More time would be necessary to fully address the science and mathematics principles embodied in 3D graphics applications in addition to learning its use as an animation tool. This is unfortunate, especially when realizing that the rich collaborations between artists and scientists forged the path to the complex graphics tools now readily available to the student.

An interesting occurrence of such a collaborative effort is found in E.A.T. (Schwartz et. al., 1992) which was a collective founded by artist Robert Rauschenberg and Billy Kluver, an engineer from Bell Laboratories. Their goal was to use the talents of artists, engineers and scientists solely for the purpose of creating art. The efforts of this collective culminated in a show in late 1966 at New York's Sixty-ninth Street Armory. E.A.T. is remembered more for its ideas than the success of those ideas but its existence gives evidence to a kindred spirit found in artists and scientists.

While this spirit is alluded to in class lectures, the primary emphasis of the course is naturally placed on learning how to model and animate to create effective communication. The student's background skills are drawing, storyboard creation, traditional animation and video or film production--not science or mathematics.

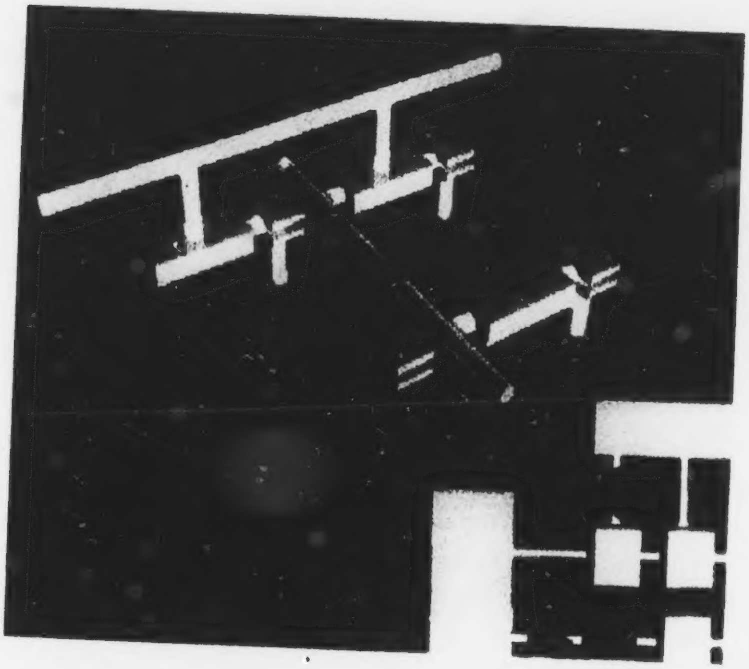
Within that context it follows that the 3D animation class be taught from the perspective of cinema and traditional animation. Students continue to learn about camera placement and movement and how the camera is used to explore relationships between the scene space, objects and characters. They learn to apply and control traditional animation principles such as anticipation, exaggeration, squash and stretch. The assignments revolve around animation and cinema techniques with the animation's content determined by the individual student. Their roles in the production include that of writer and director.

PHYSICS IN MOTION

Mastering the Physics Principles

Undertaking the simulation of physics principles as a class animation project offered a clever way to expose the students to related scientific material within this curriculum. In addition to further developing their 3D digital skills, the students had to closely examine physical science principles in order to accurately communicate them. Upon starting the project they soon began to realize the relevance of these concepts to their experiences and particularly to their work in digital animation. Light and color, random access memory (RAM), hard drives and logic gates were particularly pertinent to their work as digital artists. They knew the familiar "01" of the computer age but rarely would refer to these as binary numbers or endeavor to add and subtract them. RAM they knew as something that there is rarely enough of and is what is blamed when software refuses to operate. However, in recreating how RAM operates they had the opportunity to become more familiar with the systems they spent so many hours on (Figure 1). Almost without realizing it they were learning about physics and the digital tools they often took for granted. They had to ask many questions, striving to understand the principles in order to convey them in the clearest and most interesting way.

Figure 1. Graphical Illustration of RAM Operation



This often led to critical inquiry into how accurate the software was in duplicating the real world in the virtual world as was experienced in the animation illustrating additive color theory. The student created the models of three stage lamps and assigned each a red, green or blue, then animated them so their colors would mix on the stage's screen. He was pleasantly surprised to find that they did indeed create white when combined. The additive (RGB) color model is the one these students are most familiar with as they work with video and digital media. But never had they so clearly put the theory to the test.

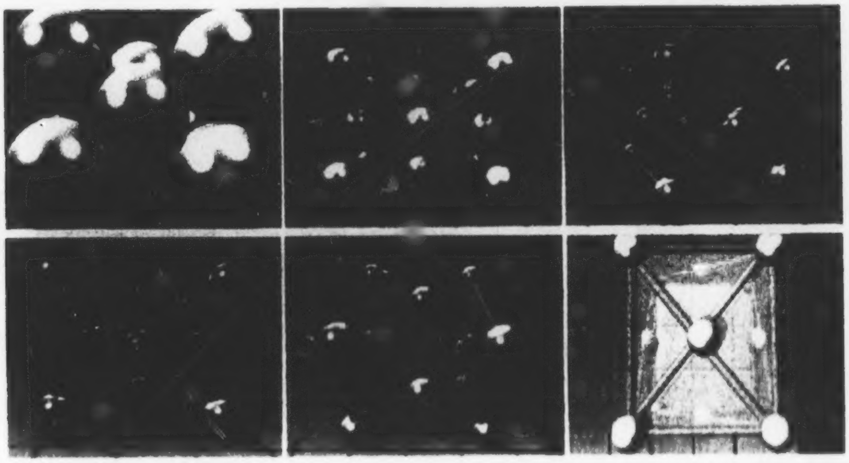
This lesson was taken further when the color lights were directed to a color screen. Again, the student wasn't confident of the software's accuracy and was inspired to research the theory further. The student's knowledge of animation enabled him to take this information and present it in an interesting and appropriate way, creating stage lights that come to life, putting on a little demonstration for the viewer. This desire to push the creative side of the project was good and made it necessary for the students to evaluate the balance of creativity and communication. Several things that they wanted to do--to use a "neat" effect or to be dramatic--they realized they couldn't do because it wouldn't be accurate.

Cinema and Animation

Being art students they usually supply the content for the productions as content development is an important part of the course. Having the content supplied for them was a welcome change and afforded the opportunity for important lessons in working with material that is not theirs. They soon realized that even though the subject matter was predefined there were still many choices they had to make. They knew what had to be communicated--their job was then to apply the cinema and animation principles they had learned. Decisions included camera placement to best convey the physics principle so that scale, object relationships and changes would be clear. Does the camera need to move? Animation techniques suddenly acquired practical usage as students worked on making objects move to create an accurate and successful visual simulation.

An example of how the camera was used to aid in the overall communication is most clearly seen in the crystalline structure animation (Figure 2). Here it was necessary to clearly show the spatial relationship of each sphere in the structure. This was accomplished by slowly tracking the camera from the side to the front of the structure, then using a "crane shot" which took viewers to the top, giving them a complete experience of the structure. To help viewers clearly see the relationships, the structure was situated in a space whose walls and floor were a grid and rods connecting the spheres came into view as the animation progressed.

Figure 2. Illustration of Crystalline Structure Animation



Teamwork

Several of the more complex simulations were created by teams, which is more often the case in the animation industry. Working as a team meant that production planning had to be addressed. They had to delegate the work load and be sure they were working with the same goals in mind. They had to be sure that colors, light, models and camera use matched, as well as learning how to share data within the software program. This created a natural opportunity for the discussion of the physics concept, as they worked together studying the reference material and interpreting it into a functioning storyboard for their animation.

The flight animation became an interesting team assignment in which both members of the team became obsessed with recreating a bird in flight. This became a serious preoccupation as they explored not only images of birds in flight, but some of the more advanced tools available in the software.

They were amazed at how the flight of the bird was actually more complex than the plane's. As a note of interest, months later they were still studying images of bird motion and their bird was incorporated into another animation piece which was included in a national animation festival!

CONCLUSIONS

The use of physics principles as subject matter for animation was a success. As one student wrote:

> I enjoyed a different take on animation for practical use. I learned much about the reading of bits and bytes from the hard disk, its internal structure, process and magnetic read.

Another student commented that by simulating how RAM works he finally felt he understood it. As a bonus it helped him win a round of trivial pursuit!

Many 3D animation students dream of working in the film or game industry as animators, digital FX artists or texture/lighting specialists. While this isn't discouraged, other uses for 3D motion are presented in the classroom. Working on the physics animation project helped students realize that practical applications are challenging and exciting and that working within a field of science--be it medical, forensics, archeology or geology--could be a viable use of their high tech animation skills.

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VIRTUAL COURSEWARE

FOR SCIENCE EDUCATION:

VIRTUAL FLYLAB AND

VIRTUAL EARTHQUAKE

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INTRODUCTION

Many educators believe that effective teaching and learning with the Web must move beyond hypertext/multimedia documents that are archives of an instructor's course notes or supporting materials (Owston, 1997). As currently used in academe, most existing Web activities represent a one-way transfer of information from author to reader (server to client). Interactivity, the very essence of the relationship between teacher and learner is missing (Clark; 1994; Schick, 1995). A student can point and click through hundreds of pages of hypertext. Multimedia is fine, but where are the challenging problems? Where are the opportunities to observe, measure, record, synthesize, hypothesize and experiment, the inquiry-based activities that promote understanding, discovery, and creative thinking. And finally, where is the "doing" that leads to learning?

The possibility for enriched Web-based activities is at hand. Browser and server software have evolved to the point where meaningful interactivity can be achieved Barry & Presti, 1996; Friedman, et. al., 1996). Server software can be linked to other computer programs (called Common Gateway Interface or CGI scripts) that create new documents "on the fly" in response to remote requests from the user. Distributed

Java applets, embedded scripts, Dynamic HTML and browser plug-ins can empower the student with interactive content within a Web page. As pointed out by Fischman (1996) and Kaplan (1997), these capabilities present an enormous pedagogical potential that has yet to be fully exploited.

The authors have developed two examples of interactive applications for learning in the sciences: *Virtual FlyLab* and *Virtual Earthquake*. Because these programs do not execute on the user's local machine but remotely in response to Web-based user input, they will be referred to as "virtual courseware." *Virtual FlyLab* models the principles of genetic inheritance and *Virtual Earthquake* teaches the concepts of how an earthquake epicenter is located and how the Richter magnitude of an earthquake is determined.

VIRTUAL FLYLAB

Virtual FlyLab is a complex simulation of the genetics of the fruit fly species *Drosophila melanogaster*. Because of its ease of culture, short generation time and high reproductive rate, this species has played a central role in research that has led to our current understanding of genetics. The general rules of inheritance that apply to fruit flies also hold for most sexually-reproducing organisms from pea plants to humans. Fruit flies are widely used for "wet lab" experimental exercises at the K-12 and university levels.

In a typical *Virtual FlyLab* session, users begin by "designing" parent flies from a menu of 30 visible mutations which are organized into groups such as "eye color," "wing size," and "wing shape". A "Mate Flies" button is clicked to submit the selections to the Web server. The request is processed and the server returns a page containing data and images for the parent and offspring flies. Below each fly image is a radio button which allows the user to select two additional flies for a second generation.

Offspring flies can also be back-crossed to one of the parents. This parallels the real laboratory situation in which students mate fruit flies from mutant stock cultures and try to determine the factors that affect genetic inheritance by examining the number and type of offspring that are produced. These factors include independent assortment of chromosomes in the production of eggs and sperm, dominant versus recessive traits, recombination of traits due to "crossing over" between chromosomes, sex-linkage of traits on the X-chromosome, traits that are lethal when two doses are inherited, genes that mask other traits, etc. In fact, *Virtual FlyLab* was modeled after many of the real mutant stock cultures that are available from biological supply companies.

Virtual FlyLab can also be used to test genetic hypotheses. On each page containing offspring flies, there is a button that produces a "test of hypothesis" page. Here the users are presented with a table of the numbers and types of offspring from the cross. Next to each table entry they can enter their hypothesis for the probability of that offspring type which would be based on their assumptions regarding the genetic characteristics of the mutations. These data are submitted and the server returns a test of the hypothesis using the chi-squared goodness-of-fit technique. If desired, additional hypotheses can be tested using the same data. *Virtual FlyLab* uses a randomization algorithm to add a realistic amount of "experimental error" independently to each genetic experiment.

All of the images in *Virtual FlyLab* are produced (pardon the pun) "on the fly" as needed. Because of the large number of possible combinations that can be produced from 30 visible mutations, it would be impractical to try and produce beforehand every possible image for every combination. To improve efficiency, once they have been created, gif files of fly images are stored and reused. There are now over 50,000 images in the "fly library," with dozens of new ones being added each day.

Despite its apparent simplicity, *Virtual FlyLab* can be used to teach some fairly sophisticated genetic concepts such as chromosome mapping, which would normally be covered in an upper division college course. Because of its apparent simplicity, it can also be used at the elementary level to teach simple concepts such as dominant versus recessive traits. In fact, *Virtual FlyLab* is being used at levels ranging from middle school to medical school.

Virtual FlyLab can be accessed from: <http://vflylab.calstatela.edu>, <http://vquake.calstatela.edu>, <http://vearthquake.calstatela.edu>, and <http://cdl-flylab.sonoma.edu>.

VIRTUAL EARTHQUAKE

The second virtual courseware developed by the authors, *Virtual Earthquake*, is an earth science activity that introduces the science of seismology--the instrumental study of earthquake waves. Earthquakes are shock waves produced by a sudden release of stored energy within the earth by rapid movement along a fault. One fundamental component of seismology involves determining the location of the epicenter of an earthquake--the point on the earth's surface directly above the origin. A second aspect involves evaluating the Richter magnitude, which is an estimate of the amount of energy released during an earthquake.

Virtual Earthquake is designed primarily for university general education students enrolled in introductory geology courses or for secondary school students of earth science. After some introductory material, students select one of four geographical areas and are presented with a set of three seismograms (the records of earthquake waves) from three different seismic data recording stations within the chosen area. For each seismogram the student must measure the difference in arrival times of two seismic waves, the "primary" and the "secondary" wave. This difference, the S-P time interval, is empirically related to the distance these waves have traveled from their origin point, the earthquake's epicenter.

Students enter their measurements into the form fields and "submit" this data to the Web server which executes the related CGI script which, in turn, calculates epicentral distances and draw circles of the appropriate radii on a map of the earthquake area. This map is returned to the user. The epicenter location will be at the "triangulation" point of the three circles.

In an analogous manner, the student can determine the Richter magnitude of the earthquake by measuring the amplitude of the waves on the seismograms and by using forms to submit their observations. A CGI script draws lines of equal magnitude on a Richter nomogram and the student can then determine the earthquake's magnitude by interpolation. If the student successfully completes the activity by accurately locating the epicenter (within a few kilometers) and by correctly estimating the Richter magnitude (within a few points), he/she is given the opportunity to receive a personalized "Certificate of Completion" as a "virtual seismologist." *Virtual Earthquake* can be accessed from the same mirror servers as *Virtual FlyLab*.

VIRTUAL COURSEWARE USAGE

Our virtual courseware is popular among educators. Our first virtual application, *Virtual FlyLab*, went on-line in June, 1995. Since then our Web site has been accessed over 15 million times. There have been over 1.2 million fruit fly "matings" in the same period (now--that's sex on the Internet!). About one year later *Virtual Earthquake* began rocking the Web. In that period users have induced over 60,000 virtual temblors. Usage of both *Virtual FlyLab* and

Virtual Earthquake has increased dramatically over time with new records being set each month. In the winter quarter of 1998, approximately 2,000 students per day were using one of these applications.

ADVANTAGES AND DISADVANTAGES OF VIRTUAL COURSEWARE

Virtual courseware offers several advantages over traditional courseware. First, there is no need to reproduce software on CD-ROMs or floppy disks and mail the media to potential users. Second, in the case of server-side scripts, one can take advantage of the processing power and storage capabilities on the server to compute results and create images. Third, there are no hardware or software compatibility issues in the development of courseware. Questions of different operating systems, memory, disk space, and processor requirements are nonexistent. Finally, bug fixes and upgrades are instantaneous. Once the new CGI scripts, *Java* applets, or Web pages are installed on the server, everyone can take advantage of them.

There are some drawbacks to the virtual courseware. First, multiple versions of Web browsers are now in use with differing capabilities. Many users and institutions are reluctant to upgrade to the latest browser releases because of the investment of time and resources required. Even worse, the two most popular Web browsers, *Netscape* and *Internet Explorer*, implement different versions of *Java*, scripting languages, and Dynamic HTML---a source of great frustration to developers and users.

A second drawback is that learners need Internet access to use virtual courseware. This is still a limitation in some educational institutions, especially at K-12 levels. A third disadvantage is that using virtual courseware may be slower than running software on the client machine, especially where competition for limited bandwidth is a problem. Lastly, server problems can affect everyone. If the power is lost or the server crashes, no one can use the software.

FUTURE WORK

Plans are in place for bringing more virtual courseware on-line. The authors have joined forces with the *California State University Center for Distributed Learning* and the publisher *Addison-Wesley-Longman* to produce a suite of biologically-related applications called "Biology Labs On-Line." One of these, an evolution simulation called *EvolveIT,* is available on the Web in beta release form <http://www.cdl.edu/EvolveIT>.

Several new geological applications are also under development including *Virtual Dating*, an activity on the techniques and theory used for radiometric age determination of rocks an radiocarbon-based materials. This new courseware will take advantage of the new technologies, including *Javascript* and *Java* applets, to enrich the user environment.

CONCLUSIONS

The "virtual courseware" paradigm has an enormous pedagogical potential for making Web sites places where students "learn by doing". Virtual applications offer several advantages over traditional courseware, the most significant being the ease of dissemination. The authors' experience with bringing two virtual applications on-line, *Virtual FlyLab* and *Virtual Earthquake*, suggests that this approach will be received with enthusiasm by the educational community. The widespread implementation and adoption of virtual courseware can bring meaningful educational content and interactivity to the Web.

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Note: If you are a science instructor and would like detailed information on the genetic mutations in *Virtual FlyLab* and suggestions for its usage, send e-mail to bob@chaos.calstatela.edu.

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ACTION LEARNING AND
MANAGEMENT DEVELOPMENT:
LESSONS FOR WEB-BASED EDUCATION

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INTRODUCTION

This paper will advocate a learning model which is firmly based within British experience. An attempt will be made to explain the educational value generated from the use of this particular model. The main focus of the paper--the use of *Action Learning* for management development in British industry by various higher educational institutions--in this case primarily refers to work at the *University of Brighton.*

It is clear that despite an originally narrow definition, the nature of *Action Learning* (Revans, 1980) continues to go through continuous reinterpretation (McGill & Beaty, 1992) as different and new groups of faculty begin working with it. Those who have worked with this model within an academic environment have consciously moved the original process from a specific and overt problem solving approach to a more generic and academic methodology.

The principles and guiding structures of *Action Learning* will tend to include the following (O'Hara, Reeve & Webber, 1996):

> Andragogical approach--a heavy emphasis on adult/adult relationships.
>
> Respect--the notion that mature participants possess an enormous amount of "lifetime"

experience; whether as business managers or simply as adults.

Control shift--faculty involved will be attempting to pass over control of the learning experience from themselves--the traditional academic "owners' of knowledge"--to the participants.

Encouragement--of co-operative and cohesive attitudes within the action learning group (usually known as "the set") to each other

Trust--clearly essential if the above is to have any meaning.

Confidentiality--essential to building interpersonal trust within the set.

Time--the allowance of time to each set member such that they feel their problems/contributions are important to and valued by the others.

Engagement--at both an intellectual and emotional level

The cycles of learning and reflection (Kolb, 1979)

The role of action learning sets within an academic program

Sets normally consist of between five and seven participants (at the University of Brighton, these are usually mangers in British industries). It is made clear to the sets that they will be taking on the prime responsibility for managing their own learning. Each set is facilitated by a faculty member and meets approximately once per month. Working together, set members generate assessment projects, statements of academic relevance or pure or applied business/management research (often based on the search for solutions to immediately pressing real problems). Participants follow a prescribed academic program, although the degree of formal curriculum versus independently structured program (Percy & Ramsden, 1980; Stephenson, 1989), varies from institution to institution.

Set meetings focus on the academic input received by participants, most commonly in the form of intensive workshops and are the fora for making sense of such input in a reflective and discursive manner. As sets settle, participants begin to value the experience of being listened to closely by the others in their set. They receive and give advice. Suggestions are made about process, methodologies and sources. Discussion is informed and bolstered by case histories, personal experience and life events from the set participants. As these sets last (at least) for an academic year, there is a depth and intimacy to the relationship which fosters commitment to, and value from, learning.

Participants increasingly construe learning in the deep sense with an evolving level of awareness long advocated in educational literature (Entwistle & Waterston, 1988; Gibbs, 1981; Marton and Saljo, 1976; Pask, 1976). It should be stressed that this is a much deeper experience (Bourner, Frost & Beatty, 1993) than collective or "group work" activities during a conventional part-time session. Often no academic work will be discussed at all--instead, issues of personal or managerial importance are explored within what over time becomes a safe environment. Very often, "learning blockages" are finally acknowledged and grappled with, freeing up the participant for much more meaningful engagement later (in learning approach terms this allows the intrinsic to grow in importance vis-a-vis the extrinsic). The small size and bounded nature of the set helps to engender this situation.

The establishment of *Action Learning* sets permits the construction of safety and security (particularly for adult learners) which can free up the exploration of learning itself. There is a deliberate policy to allow action learners the space to make mistakes, become more confident as self- referencing individuals and develop, with guidance, an intrinsic (Gibbs, 1981), and deep (Marton & Saljo, 1976) approach to academic study and managerial life. Further development of cooperation and mutual support often moves sets towards and into realms of emotional commitment, further deepening the experience beyond that attainable on a more standard academic program.

Something often referred to as invaluable by participants (and to some extent almost a by-product of the model), is the fact that as the set members' research/academic work is progressing, it is scrutinized far more frequently and carefully than would normally be the case. Work passes before several interested co-members with the benefit of substantially raising the standard of individual academic performance.

Thus, when working with adult students, the deeper the learning approach engendered, as suggested by theories which focus on approach (orientation) and "fit", the more successful the outcome. The term "outcome" includes here personal satisfaction and sense of enjoyment as well as standards/qualifications achieved.

The work of Biggs (1985) and Entwistle & Watterston (1988), establishing the effectiveness of deeper learning orientations and confirmed by studies conducted specifically on open/distance learning by Harper and Kember (1989), continues to be validated (Richardson, 1994; Scouller & Prosser, 1994). Such theories, combined with actual case experience, form the framework for the educational philosophy pursued within the *Centre for Management Development* at the *University of Brighton* defined as *Action Learning.*

NON-LOCAL AND TECHNOLOGICAL DELIVERY

The importance of the preceding section was to emphasize the educational value generated by a specifically personal approach to learning. Having accepted that certain learning approaches generate better learning outcomes, the active and conscious use of a philosophical model in which the individual is placed within a tightly formed group seems to produce good results. The levels of deep learning and awareness of learning *per se* can be encouraged.

It will no doubt be clear, however, that the preceding model implies relatively low economies of scale in an era of stringent controls of limited budgets. Rather than attempt a defense or refutation of such an interpretation, the aim of this paper is to inquire how far the benefits deriving from such a system or philosophy may be replicated within a much more extensive (or even distance) system.

This is where the issue of technology, or delivery system, is so important. Traditional open learning (particularly in the U.K.) has demonstrated many features at the polar extreme to the kind of educational experience outlined so far in this paper. Much open learning-based education/training demonstrates similarities to the *surface, externally referenced* (by its very nature) and *dissemination-based* learning (Hodgson, Mann & Snell, 1987) associated with less effective learning outcomes than to the deeper, meaningful learning identified within educational literature.

Individual experience, in particular, may demonstrate harmful outcomes from following a distance/open course model. In recent years, concern has continued about the high drop out rate, originally analyzed by Glatter and Weddel (1971), given the European emphasis on lifetime learning.

The experience within the U.K. of the major failure of a mass further education program known as the Open College project (Reeve 1990) further calls into question the overall educational experience of open/distance learning models. Coupled with the attrition-based system of even the most successful and lauded open learning institution, the *Open University*, whereby the preponderance of early paying withdrawals guarantees the security of the remaining minority who stay the course (MacKenzie, Postgate & Scupham, 1975), the history of distance learning is clearly informative.

If the focus for higher education should be on helping students in the journey toward intrinsic approaches, deep learning and holistic perspectives, then a delivery system which can emulate or incorporate the features found within *Action Learning* as described in the earlier part of this paper would seem to present a major opportunity. This is where cautious optimism might prevail. There is no doubt that the delivery mechanism for open learning has undergone a step change--as net-based, more or less interactive, and closer asynchronous contact structures have evolved.

This current emphasis on interactive education mediated through Web-based structures clearly offers a great deal for learners. It is important however, that the educational *reward*, or educational *value*, be considered at the same time as what might be called the educational *effectiveness of delivery*. While still in the relatively early stages, the opportunity must be seized to clearly enunciate an educational philosophical position about the role and power of Web-based education, not merely its operational efficiency. Thus, there are two issues to be addressed:

> Of a general nature, the debate around the nature of learning (and effective learning at that) must be joined. If deep, intrinsic and

> strategically organized learning (Biggs, 1985) is deemed to be most effective, how should Web-based, particularly interactive, approaches be created?
>
> Of a much more specific nature, the thrust of this paper is to explain the positive educational benefits flowing from a particular educational philosophy, *Action Learning*. Built upon the conceptual basis of small group, tightly cohesive and deeply committed educational participants, is it possible that similar value could be generated for users of network learning?

In terms of the first question, it is clear that Web-based learning systems allow educational access to self-motivated and autonomous learners--particularly mature learners aware of life-long education. Programs designed to be promulgated via Web-based delivery will no doubt hit the spot in general terms for such learners.

However, how often would such programs merely demonstrate the mechanization of an existing program, in the traditional distance learning sense? Worse, how often would such mechanization have created (albeit in attractive technological form) a surface, serial, extrinsic experience, as opposed to a deep, holistic, intrinsic experience?

If such issues are to be addressed, there should clearly be an educational pause and check stage during the design of courseware or server distributed material. At such a stage, deliberate philosophical questions could be asked and answered as to the overall approach of the learning material and potential learning experience. Whether a Web-based model will influence standard educational practice or whether eventually standard educational practice will influence Web-based learning is a moot point.

It would appear that two somewhat separate influences are at work here. On the one hand, an example of the specific efforts being made to organize and deepen the learning experience of Web-based collaborative learning is in evidence, for example, at the *South Bank University Collaborative Learning Workshop* site <http://www.sbu.ac.uk/ace>. There is also a clear attempt to evaluate the educational effectiveness of information technology approaches--in particular, a U.K. government-funded suite of projects--*Teaching and Learning Technology Projects*, to be found at <http://www.tltp.ac.uk>.

On the other, the rhetoric about mass implementation of information technology (particularly Web-based) educational structures continues unabated as technology allows the supply chain of education to speed up and serve more students--more widely distributed and more diverse--at the same time. The mythology and potential danger of competing institutions has grown as the concept of virtual-U, corporate college and narrowly specific niche suppliers has taken root.

If these two trends begin to converge, i.e., the educational philosophy behind design and operation and distributive power, the most likely point of contact will be the effective integration of such systems into the *mainstream* higher education structure. Again, the history of distance learning may be instructive. Attempts to embed traditional package-based "open learning" into mainstream curricula (Reeve, 1993) demonstrate drawbacks and distinct dangers for less mature, culturally group-based learners.

It is important, therefore, to bear in mind one more issue at this point of convergence--and this is the nature of social learning within local higher education environments. Indeed, this point of integration has also formed the reference point for the evaluation of teaching and learning technology interventions (Draper, Brown, Henderson & McAteer, 1996), where although meta level approaches (deep, intrinsic etc.)

are admittedly not evaluated, individual embedded classroom interactions certainly are.

THE SOCIALIZATION OF THE LEARNING EXPERIENCE

Given the extent of the problems which might lie in wait for the development of deep learning over an extensive information technology-based delivery system, the potential to generate the outcomes related to *Action Learning* as an innovative methodology are perhaps even more daunting. The potential to recreate the benefits of *Action Learning* as an educational process within a networked, open learning model does exist, however. In some senses such an attempt might be deemed to militate against certain deeply held views about the nature of access and open learning, but this need not be the case.

A cohort of whatever size of distant learners could be divided into virtual action learning sets consisting of five to seven members. Induction to the philosophy and expectations of such an approach would have to be carried out, and "buy in" sought. Tutorial time could be allocated such that each set had a facilitator.

As long as set members were prepared to give to each other in the same sense as physical set members do (lowering protective barriers to each other and providing both emotional and professional commitment) and facilitators were prepared to orchestrate in their usual fashion (albeit somewhat moderated by the virtual nature of the exercise), it could be that this kind of model would generate deep learning from a Web-based architecture. This would not result from the delivery mechanism itself, but from the socialization of the interpretation of the delivered and/or interactive academic material.

Thus, just as conventional action learners deliberate and pursue ideas following standard input, so too would Web-based action learners. Hopefully, just as conventional action learners move toward deeper and more effective learning approaches, so would their virtual equivalents. If the autonomy and self responsibility of learners is stressed at the outset and they are then given the support, safety, security and challenge of a set group, there is every possibility that such an educational/social construct would allow them to develop as learners far more strongly than if they were left as isolated learners.

Although an extremely important development in terms of learning socialization, virtual cafes and bulletin boards could not generate the same depth of commitment. Furthermore, such a socialized model preempts the need for the Web-based material itself to have been so rigorously pre-prepared to generate the most effective outcomes. The onus will have been taken away from the courseware designers and network controllers to inculcate deeper learning and shifted to the teachers and facilitators to create such interpretation.

There is a deliberately provocative thread to this paper. Technological systems, particularly networked information technology- based education, continue to hold the moral high ground in terms of their provision of ever wider access. Such improvement of access sits firmly within the distance learning paradigm--and to a certain extent this paradigm drives the nature of courseware development and program structure where the focus remains on the *individualized* experience.

The wider the distributed access and the more individualized the program, the greater is the potential for learner isolation. Individual learners may not be able to explore academic material in the most meaningful way and instead adopt sets of learning strategies which will generate less value. There is the potential for a scenario to develop where more learners than ever before embark on learning programs but at the same time more disenchanted, confused and dispirited learners than ever before give up and withdraw from such programs.

Some variant of the proposed virtual *Action Learning* set could improve such a situation. If educational planners and managers consider much more explicitly the social intervention necessary to enable deeper learning to take place, then the full benefits of information technology-based delivery may become achievable.

Thus, the deliberate "closing in" of small circles (i.e., into set structures) although seemingly contrary to the conventional wisdom of open and wide access, would allow the potential generation of deep learning. Specifically facilitated, such sets could be helped in their own exploration of the meaning of learning. This does not imply the turning of an individual's back against the rest of the network users, but it does imply that structured and facilitated intra-group relations become deeper and more integrated than inter-group or individual relationships to the rest of the program participants.

CONCLUSIONS

The essence of this paper is that an innovative, conventional (i.e., not open/distance) educational methodology has resulted in the kinds of learning stressed within educational literature as the most effective and desirable. Distance, open and increasingly network-based learning programs may not be capable of eliciting the most effective or favorable approaches to learning.

Would it be possible for some of the attributes of the former to be present in the latter? The argument presented here is that they could, and in a specific manner. Rather than looking to build in deep learning approaches somehow within the technology (particularly courseware), a social intervention instead could be justified. Here, faculty would orchestrate and elucidate the debate on learning to learn, organize virtual sets and facilitators and engender the conditions for successful learning.

Clearly, this role is a familiar one, and one which educators currently hold--but this could hold the key to the future. The power of the Internet to reach individuals, coupled with the social and professional skills of enlightened educators, may symbiotically generate effective and meaningful learning. The future may not consist of advanced software and deskilled educators, or head on collisions between conventional localized human systems and pan continental Web-based programs--but instead, rather more prosaically, of dynamic potential within Web-based systems tamed and made useful by skillful educators.

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IMPROVING STUDENT LEARNING THROUGH BETTER DESIGNED WEB-BASED COURSE ENVIRONMENTS

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INTRODUCTION

The use of innovative technologies to deliver distance education programs has made it possible to reach more students, certainly more efficiently and potentially more effectively. The World Wide Web continues to gain popularity as an instructional medium for post-secondary institutions. Students can choose to take courses and, in many instances, entire degree programs from a distance.

As the number of students wishing to learn on-line continues to grow, it is becoming increasingly important for educators to create on-line learning environments which can accommodate the individual needs of each learner. Distance education programs, while reaching many individuals who may not otherwise have been able to take university courses, can be more destructive than constructive if improperly designed and delivered.

The electronic learning environment may be the only way for course content to be learned for students who do not have the opportunity to attend class on campus. Learning can be compromised if course material is difficult to access or presented in an ineffective way (Parker, 1996). Further, ignoring student individual differences can hamper the effectiveness of human-computer interaction (Burger,1985; Friend and Cole, 1990; Cordell, 1991; Gaston and Arndt, 1991; Marcoulides, 1988; Ross, 1997; Ye & Salvendy, 1994). Just as classroom instructors should strive to meet the diverse needs of their pupils by incorporating a number of teaching strategies into daily lessons, so distance education providers must move towards structuring virtual environments which allow students to access materials--and learn-- in ways that suits them best.

BACKGROUND

Corno and Snow wrote "The success of education depends on adapting teaching to individual differences among learners" (Corno & Snow, 1986, p. 605). The authors stress that it should be the teacher's goal to create a *nurtural* classroom environment for students--one which is created by the teacher adapting the environmental conditions to the learner's present state. Failing to meet the individual needs of students in the traditional classroom could have a detrimental effect on learning outcomes (Corno & Snow, 1986). The on-line classroom should be no different.

Much research in the area of student individual differences (or individualities) and their impact on learning has been conducted over the last several years (Ross, 1997). However, in the "mad rush" to re-purpose content for Web-based delivery, course developers often overlook what has been uncovered about student differences in the classroom environment, failing to apply sound instructional design principles to the on-line learning environment (Gunawardena & Boverie, 1993).

Research has shown that student differences such as cognitive learning style, level of domain knowledge possessed, and attitudes towards technology impact the way they interact with, and learn from, the computer (Burger,1985; Cordell, 1991; Friend and Cole, 1990; Gaston and Arndt, 1991; Marcoulides, 1988; Ross, 1997; Ye & Salvendy, 1994). Thus, in order to avoid alienating certain learners, distance education course should be developed in such a way as to address student individual needs.

In terms of learner individualities and computer technology, a study conducted by Ross (1997) found that computer-aided instruction may alienate certain learners. In particular, students who desire social interaction as part of the learning process, and think in a multidimensional, random-like fashion have difficulty adapting to computer technology (Davidson Savenye & Orr, 1992; Fauley, 1991; Gregorc, 1985). In contrast, students who think in a sequential, linear fashion and enjoy working relatively independently in isolation, appear to learn well from computer-based instruction.

The implications from the Ross (1997) study suggest that course developers need to be cognizant of how they design and implement new technologies. It would appear that not all learners benefit from human-computer interaction experiences, a finding which has implications for higher education institutions wishing to place courses on-line. Many learners may be "at-risk" for suffering adverse effects from their on-line experiences.

RATIONALE FOR A CHECKLIST

There currently appears to be disparities that exist between on-line courses in regard to design and implementation. Some on-line environments are extremely effective, providing numerous features and intuitively designed interfaces which can be adapted to meet the individual needs of the learner. Other courses clearly need more work in order to ensure positive learning outcomes for all learners involved.

To provide an organized method to identify crucial points in the design/development of online course materials, a checklist is provided on the following pages. While it is not the intent of the checklist to find fault with current course delivery programs on the Web, it is hoped that the features delineated will give course developers impetus to structure more tolerant learning environments--environments that can meet the diverse needs of learners.

The presented features stem from literature in the area of distributed education and from the author's experience as an instructional designer for a post-secondary distributed education program. Some of the points from the list are non-technical in nature; others require course developers to move beyond the default features included in most current distance education course environments (i.e., a plethora of text interdispersed with some pictures, an animation or two, an asynchronous bulletin board system, and a simple navigation bar). Regardless of the technical nature of each of the points to follow, course developers are encouraged to adopt, or at least consider, some or all of the recommendations presented in the checklist.

USING THE WEB-BASED INSTRUCTION CHECK LIST

Overview. Designed to be used as either a guide for the course developer or as an evaluation tool for the researcher, the checklist delineates features which should be present in online courses being delivered *entirely* via the Web. Evaluators may wish to simply check off the existence of features, or may obtain a quantitative value for the course being reviewed by totaling the number of checks.

Directions. There are 86 evaluation criteria, some of which have expanded lists. Place a check in the appropriate column to indicate the presence, absence or applicability of the criterion. Total the amount of checks in the 'Yes' column to obtain the final score for the course. ***It should be noted***

that this checklist is not intended for on-line course material which serves to supplement face-to-face class meetings.

DISTRIBUTED LEARNING CHECKLIST

FEATURES	YES	NO	NA
Testing and Recordkeeping			
On-Line Gradebook			
Class Statistics			
Student Statistics			
Quick Quizzes Provided with Answers			
Submission Forms for Essays			
Some Formal Testing Done On-Line			
Multiple Choice Questions			
Short Answer Format			
Functionality:			
Site Map			
Available At All Times			
Clickable Map			
Extensive			
Student Tracking			
Shows Pages Visited/Not Visited			
Total Time Logged In			
Multimedia			
Video			
Streamed			
Course Messages Area			
Lectures Files Available			
Animations/Shockwave			
User Interface:			
Consistency of Layout			
Intuitive (e.g. Self-Explanatory Icons)			
User Feedback (e.g., Roll-overs)			
Measures for Individualized Instruction			
Based on Learning Style			
Based on Formative Evaluations			
Based on Field of Experience			
Based on Assignment Preference			
Reasonable Load Time			
New Window for External Browsing			
Appropriate Use of Media			
Non-Technical Features:			
Print Version of Student Handbook			
Face-to-Face Orientation Day(s)			
Student Survey/Feedback On-Line			
Off-Line Assignments			
Off-Line Learning Materials			
Learning Styles Assessed/Interpreted			
Computer-As-Tool Philosophy			
Total: ____________			

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DISTRIBUTED LEARNING CHECKLIST

FEATURES	YES	NO	NA
Student Tools			
Glossary			
Searchable			
Linked to Origins in Body Text			
Words Pronounced			
Course Content Indexed			
Expandable or Contractible Lists			
Indicates What Pages Completed			
Bookmarking/Resume Session			
Searching			
Boolean Operators			
Search for Internal/External Sites(s)			
Related Links Page			
Links are Categorized			
Links are Current			
Links Can Be Searched			
Form for Submitting Links			
Note Book Management			
Edit Book's Contents			
Print Book's Contents			
Export Text			
On-Line Help			
Extensive			
Available At All Times			
Webmaster's Email Provided			

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DISTRIBUTED LEARNING CHECKLIST

FEATURES	YES	NO	NA
Collaboration Tools:			
Asynchronous Communication			
Newsgroups			
Listservs			
Bulletin Board System			
Threading			
Sorting (by topic, poster, etc.)			
Post URL/Graphic			
Synchronous Communication			
Easy to Use			
Supports Multiple Users			
Private Rooms Can Be Created			
Shared White Board			
Class Lists			
Searchable			
Student Pictures/Interest			
Student Email Addresses			
Administration and Security			
Student Log-In Required			
Ability to Change Password			
Log-out Required			
Counter/Server Traffic Reports			
Multi-Browser Use			

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CONCLUSIONS

In the "race" to develop online worlds which seek to bring the university to the home environment, the learner should not be overlooked. While it is understood that implementing many of the recommendations presented in this article would be costly and time-consuming, no one wants to alienate or isolate learners. If institutions are going to move towards an on-line model of distance education, then more “tolerant” learning environments need to be constructed. Just as the faculty member must evaluate critically the methods and delivery style used in the traditional classroom, so the on-line course facilitator must continue to move beyond the idea of using one format to teach many learners...*Too many minds are at stake.*

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A HYBRID CD-ROM/INTERNET INTRODUCTION TO MUSIC COURSE

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INTRODUCTION

This paper attempts to describe the design of courseware for a self-paced, non-major music course with a novel method for its delivery. The courseware, *The Anatomy of Music* (Sonnenschein, 1993), was designed as a stand alone, self-paced, computer-mediated, interactive, multimedia program. Its central didactic objective was to develop in the learner the skills needed to cognize auditorily details of structure in a composition and thereby attain some cognition of form in music without the use of musical notation.

Learning takes place in a "virtual class" and the Internet serves as a communication vehicle between students and instructor as well as between students and their peers. This course has now been offered for two quarters as a free elective at Northeastern University in Boston.

DESCRIPTION OF THE COURSEWARE DESIGN

Overall Organization. Of the six sections (chapters) that make-up the program, five follow the same overall organization. This organizational plan includes four sub-sections: 1) a primary learning tool; 2) historical background information; 3) listening exercises; and 4) a test module.

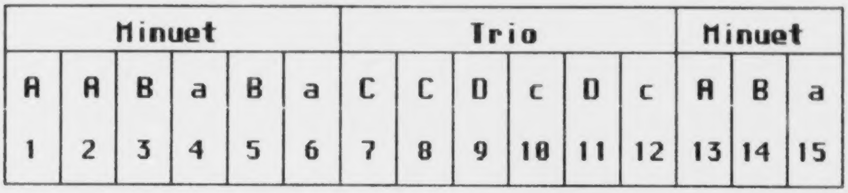
The sixth chapter is devoted entirely to a single work. Beethoven's third symphony, the Eroica, follows a different organizational plan. This chapter contains only the primary learning tool and historical background information. The purpose of this organizational difference is to challenge the learner to apply acquired skills to a novel situation. This chapter is the source for the listening part of the final exam.

The Four Sub-Sections. The primary learning tool contains animated graphics of formal musical analyses. Here, students learn conceptually and perceptually about musical forms. Musical forms are seen as abstract prototypes of a whole class of musical compositions. It is assumed that learning is enhanced by simultaneously employing auditory and visual modalities--listening to the music and viewing the synchronized animated graphics on the screen. Interacting with the graphics on the screen affects the music heard and thus facilitate learning by experimentation.

The main task preceding the development of the courseware involved selecting appropriate musical examples to suit the purpose. These examples were then analyzed into such syntactic units, or musical strings, that the average learner could be expected to perceive them auditorily. Obviously, the dissected syntactic units had to correlate with the actual structure of the forms, so transferability of what was learned in the course to real-world situations would be enabled. Consequently, the analyses represented each form at its most general or inclusive level, its metaform.

The actual program development began with the preparation of graphic representations of the musical forms to be used in the course. In the program, these are called form-maps. The following is an example of the form-map of a minuet (Figure 1).

Figure 1. Form-Map of a Minuet



Minuet						Trio						Minuet		
A	A	B	a	B	a	C	C	D	c	D	c	A	B	a
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Since the program was designed to synchronize animated highlights on the form-maps with the appropriate music played over a CD-ROM drive, the learner could observe both visually and auditorily the relationship between the form-chart and the music. Because of the interactive design of the program, the learner could click on any one of the boxes of the form-map to instantaneously hear that section of the music that synchronized with the location on the form-map. This enabled the learner to learn by experimentation. Comparing various sections and listening repeatedly to those sections experienced as being unclear reinforced the learner's auditory understanding.

Historical Background Information. All historical background information related directly to the musical examples the learner worked on. Similar information was also available in the workbook and this material was needed later for the final exam. In this courseware, developing listening skills was the primary objective. Consequently, all the historical background information provided was limited in scope. What was provided was the information that related directly to the issue at hand. For example, when working on the minuet, information was provided about the development of the minuet into a staple of symphonic music during the Classical period.

Listening Exercises. The listening exercises are tools for students to practice their listening skills without fear of failure. Here, the program presents a screen containing the form-map of a selected composition. Once the learner starts the music, clicking on a box thought to coincide with the music heard will highlight the box and add to a score if the assumption was correct. Wrong assumptions score negatively and the box is not highlighted. Listening exercises are just for practice and the score is not saved for evaluation. Each listening exercise can be stopped at any time and a new attempt can be started as many times as the student requires.

Chapter Tests. Each chapter contains a test module. Unlike the listening exercises, the tests select randomly from the music learned in the chapter. After the music is selected, the program will highlight a number of boxes (this is also randomized) and students are expected to click on the highlighted boxes in real-time. If correct, the box highlight will clear and a score will accumulate. Wrong answers will reduce the score and the highlight will not be cleared. Students have to attain a predetermined score. Once the score has been reached, students can move on to the next course chapter test.

METHOD OF DELIVERY

The Material. The program packet includes a floppy disk containing an installer for the computer program and a file for collecting data of student's work (the disk also serves as a key disk), three CDS, and a workbook. The CDS contain all the music required for the course and are interacted with by way of a CD-ROM drive. The workbook contains a detailed discussion of the course's objectives and its central problems as well as historical background information related to course content. The courseware design allows students to work at their own pace and at any location, provided they possess access to the Internet.

The Home Page and the Web. The communication center for this cyber class is the course's Home Page. It contains several links to other locations (such as university administrative centers for registration), as well as to the publisher of the text materials for the course. In its communication function between student and instructor, the Home Page is used for the periodic uploading of test results accumulated on the student disk. Space on a server at the university was set aside for this purpose. The instructor can download student files from the server and save them with a separately designed course management program.

In addition to its homework function, the Web is also used for e-mail communication between instructor and students. Major uses include answering student questions, prompting, or providing additional information or explanations when needed.

To encourage class participation, the instructor periodically poses questions on the conferencing program which is accessible from the Home Page. Ability to answer these questions requires task-oriented listening. Students are not graded on these questions. After seven to ten days, the instructor posts the answers. All who participated in a meaningful manner between the time a question was posted and the answer provided are credited for class participation. The same conferencing program is also usable for discussions between students and can thus be used for cooperative learning.

COURSE CONTENT AND COMPLEXITIES IN TEACHING MUSIC LISTENING

For this course, music cognition is defined as being made up of three related elements: 1) knowledge of several of the most common composition plans--the forms--of musical masterworks composed between c.a. 1720 and c.a. 1920; 2) ability to discriminate by auditory perception between discrete musical events that define these forms; and 3) ability to categorize these musical events according to their proper location and function along a known musical form.

Given the ineffability of the emotional and aesthetic qualities in general, the qualia, as discussed by Edelman (1989; 1992) and of music in particular, this college introduction to music course, designed for the non-major in music, applies a novel approach by utilizing musical syntax as the central didactic strategy for the achievement of music cognition. The aim is for the student to attain skills in perceptual categorization of sonic data into coherent musical statements.

The historical period selected contains composition representing some of the greatest human achievements. One objective of this course is to make these masterworks accessible to anyone who is interested but who may feel intimidated by lack of musical knowledge in general--and lack of music theory and music reading skill in particular. Composers of the period under consideration composed their works for amateurs and not for the music theorists. As Mozart's 1782 letter to his father confirmed (Anderson, 1966), composers took great pains to create compositions within the accessibility limits of their listeners by following established norms. One of these norms related to the syntactic order or forms to which all composers adhered.

Many who listen frequently to classical music, including most professional musicians, are unaware of their own mental processing as they listen. They already have attained the necessary skills and possess the required knowledge and thus listen to music as one listens to language, i.e., without paying attention to its syntax or grammar. Many others, however, need instruction to attain the needed skill and knowledge--it is for those that this course was designed.

Although understanding musical form and possessing the skill of becoming aware of it by listening can provide considerable satisfaction, the course aspires to a broader objective. Most written accounts of music, whether in program books for a symphony concert or in music appreciation books, refer to musical events in a specific composition. To locate these events, the reader either has to have memorized the work, be able to read the musical score or know the form of the work and have the skill to follow it auditorily. Thus, since the achievement of the last of these presents the main objective of this course, its approach and content are intended to provide a solid basis for the continuous accumulation of musical knowledge that reaches beyond the limits of this course.

EDUCATIONAL CONSIDERATIONS

One learning theory that permeate this hybrid Web/CD-ROM computer-mediated course pertains to what is known as mastery learning. Students have to attain a certain level of mastery before moving on to the next stage. But unlike the classic application of this theory, students are free to learn by experimentation and may select objects of study out of any prescribed sequence. This brings the didactic strategy closer to the constructivist approach (Bertrand, 1995). It is assumed that most students can learn the materials if they are permitted to do so at their own pace and in their own manner.

Another instructional philosophy underlying the design of this courseware is the belief that a general principle is of greater value than learning specific instances of it (Bruner, 1960). As applied here, the focus is on comprehension and perception of a form and not on any number of compositions in that form.

Assessments are performance-based. It matters not how much time was needed to complete a chapter test. Grades for this course are determined by number of chapters completed, class participation and performance on the final. Currently, the course is available only to students of Northeastern University. It adheres to the university's time schedule and the course therefore has to be completed within one term. Future plans call for making the course available to students outside the university. This may make its scheduling more flexible.

SUMMARY AND CONCLUSIONS

The course described in this paper may be classified as a music appreciation course if the term is understood in its broadest sense. The traditional organization of music appreciation courses included basically four different orientations--historical, structural, humanities and skills (Rubin, 1972). Nevertheless, all of these diverse orientations were fundamentally text-based and the learner had to read instructions on how to listen to music. In all of these courses the delivery was by way of lecture/recitation with musical demonstrations (usually keyboard) by the instructor.

What sets the course described in this paper apart is its orientation and its method of delivery. Its orientation comes closest to the skills oriented courses. But rather than read about how to develop listening skills, the course makes use of current computer technology that provides the learner with an interactive tool for learning by experimentation and provides ample opportunities for meaningful practice. The CD-ROM/Internet presentation of the course presents a radical departure from the past. Further--the course is based on current theories of learning. It is designed to develop music cognition by way of auditory perception. It requires the learner to interact directly with the material (Olgren, 1998) and thus to become an active participant in his or her acquisition of knowledge (Bertrand, 1995).

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USING A BULLETIN BOARD SYSTEM FOR COLLABORATIVE, CROSS-CULTURAL LEARNING

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INTRODUCTION

At the elementary and secondary level, organizations have evolved to enhance learning through multicultural experiences using global telecommunications, especially the World Wide Web. For example, the *International Education and Resource Network* (1998), a project of the *Institute for Global Communications,* links teachers and students from 30 countries in projects involving the environment, world peace and other global issues. GlobaLearn (1998) offers many interactive trips and learning adventures. MayaQuest (1998) offers interactive trips and learning adventures in Central and South America, including opportunities for conversations with archeologists. Big Sky Telegraph Web site (1998) maintains links to many self-directed learning resources and distance-learning opportunities, including collaboration with students located across the world.

Since 1993 the senior author has been a consultant to the *Management Education in Poland Project*, a U.S. AID-funded joint effort between the *University of Maryland* and the *University of Lodz* in central Poland. As part of that project, the senior author and a colleague in Poland initiated an electronic discussion group between students in a Computer Literacy course at *Prince George's Community*

College in Maryland and graduate students taking a seminar in Informatics and Econometrics at the *University of Lodz*.

While successful according to all participants, this discussion group was nevertheless inhibited by the wide disparity in technical knowledge between the U. S. freshmen and the Polish graduate students and by the small number of Polish students with sufficient English language skills to participate meaningfully. As a result, the decision was made to seek out another international contact for an electronic discussion group, involving students with more nearly equal computer skills and preferably with better skills in English. The project that resulted is reported here. It was designed with a view to extending the opportunity for cross-cultural, collaborative learning at the higher education level.

PROJECT DESCRIPTION

Prince George's Community College uses *Worldgroup Manager*, a commercial bulletin board system (BBS), as the means of achieving student-to-student and student-instructor collaboration and communication for its distance learning courses. The BBS server software runs on a computer at *Prince George's Community College*. Students world-wide access the Internet from their own Internet service provider and thereby connect to the BBS. This BBS system is currently supporting about two dozen class and faculty discussion groups.

During the summer of 1997, the authors communicated via e-mail and agreed to use the BBS to develop an asynchronous discussion group among first year computer students at *Prince George's Community College* and at *Technikon Natal* in South Africa. Agreement was then reached on the outline of the student discussion group and a list of nine discussion topics, as well as a schedule--the latter complicated by the fact that academic terms in Maryland and South Africa do not coincide whatsoever.

For each discussion topic, it was agreed that students in both countries would have one week to make an initial contribution and then would have a second week in which they would be expected to respond to the contribution of another student. The second week of each discussion period overlapped with the first week of the following topic so that all nine topics were covered in ten weeks.

BULLETIN BOARD SYSTEM

DISCUSSION QUESTIONS AND SCHEDULE

Topic 1. September 13-20

> Introduce yourself to your classmates. Give your name, major, background, previous computer experience, hobbies, and interests.
>
> In what ways do you want to become more computer literate?
>
> (*Respond to a classmate's introduction September 13-27.*)

Topic 2. September 20-27

> Commercial, general-purpose computers represent character data internally by using either the EBCDIC or the ASCII coding systems. Name and describe another coding system which humans have invented and compare/contrast it with ASCII.
>
> *(Respond September 20-October 4.)*

Topic 3. September 27-October 4

Develop an algorithm for getting gas into your car at a gas station. Consider types of alternative actions you might take regarding the grade of gasoline, the use of credit cards and self-service, depending on the weather and other conditions.

(Respond--critically but gently--to a classmate's algorithm, September 27-October 11.)

Topic 4. October 4-11

What do you understand by the term artificial intelligence and in what ways do you think the implementation of this concept can be useful to us?

(Respond October 4-18.)

Topic 5. October 11-18

List and describe three Web sites which you have found interesting and which your classmates should look up. Don't forget to include the URL's in your forum posting.

(Respond October 11-25. When you respond to a classmate, start by looking up that classmate's favorite Web sites before you write your response.)

Topic 6. October 18-25

Give an example of a real-life situation that could be presented interactively on CD-ROM to help students build problem-solving skills.

(Respond October 18-November 1.)

Topic 7. October 25-November 1

Which of the computer pioneers in the Smithsonian's Information Age exhibit did you find the most interesting? Why? Which of the pioneers made the most significant contributions to the development of the computer? Why?

(Respond October 25-November 8.)

Topic 8. November 1-8

Research new career opportunities for people with computer skills.

(Respond November 1-15.)

Topic 9. November 8-26

Open forum (and makeup discussion): If you missed one of the earlier BBS discussions, or if you just wish to contribute a "parting shot," here is your chance to sound off. Share new Web sites you have discovered. Pleasant good-byes to your classmates and pen-pals. Reactions to the course which you would like to share. Suggested improvements to the course.

(Respond November 8-26.)

ELECTRONIC COMMUNICATION LINK

The communication link between *Technikon Natal* and the *Prince George's* BBS server was established via the *Netscape* plug-in. *Prince George's Community College* granted user IDs and passwords to the South African students. At *Prince George's*, the senior author decided to include both his class of distance learning students and another class that met regularly in an electronic classroom. In the end, there were 47 participants in the discussion group--37 from *Prince George's* and 10 from *Technikon Natal*.

SUMMARY AND CONCLUSIONS

The authors used a commercial Bulletin Board System (BBS) on the Internet for an asynchronous electronic discussion group among first year computer students at *Prince George's Community College* and at *Technikon Natal* in South Africa. Students discussed both technical (content) and cross-cultural issues. This successful and easily replicable project demonstrated how technology can be applied to both achieving cross-cultural communication and enhancing technical learning.

Evaluations from the participants indicated this was a significant learning experience for students on both sides of the world. Evaluations of the experiences encountered in this project will form the basis of future communication between both institutions.

One particular issue that needs to be examined is the number of participants in any single discussion group. Too many voices means that some voices are rarely heard, or that everyone spends an inordinate amount of time reading the plethora of postings. An ideal discussion group might more appropriately have 15 to 20 participants, much like a college seminar.

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EXPLORING FACTORS

THAT MODERATE LEARNING AND TEACHING

IN A WEB-BASED COURSE

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INTRODUCTION

A rapid change in technology in recent years has provided the impetus for many instructors at all educational levels to revisit their ideas about learning and student-teacher interactions. Computers offer easy exchange of text-based and graphic materials--and increasingly, the opportunity to observe and hear others in real-time interactions. Operating somewhere between the promises made by advanced technology advocates and the underdeveloped technological environment of most classrooms, many educators are attempting to redefine the role of educator and student while maintaining a high level of quality and expectation appropriate to the university environment.

There is little question that the use of the World Wide Web has increased significantly and has had a major impact on academic institutions. Ciolek (1998) conducted an e-mail survey to subscribers of seven English language e-mail lists specializing in Asian and Pacific studies and found that the most popular uses of the Internet were sending and receiving e-mail and reading on-line news. Also, the study identified the three most popular construction activities as the development of personal Web pages, investigation of the Internet and maintenance of the various mailing lists.

The use of the Web as an instructional delivery tool has, in many cases, changed the way faculty teach. It has created advantages to those who use it since it permits users not only to specify goals to pursue, accept diversity of outcomes, request production of knowledge and evaluate at task level and build learning teams, but also encourage global communities (Duchastel, 1997).

The Web has also become a viable tool for the delivery of training programs in business and industry. Documented reasons given for the increasing use of the Web are its ability to reach a geographically dispersed audience, ability to access training materials at any time, ability to deliver accurate and current information and the ability to access the Web from various computing platforms (The Training Place, 1998). Crossman argues that the Web "has the potential to become the most comprehensive communication system ever developed." (Crossman, 1997, p. 23).

The journey to becoming adept in using the Web as a new medium for instruction poses new challenges for all concerned--faculty, administrators, staff and students (Boettcher, 1998). For faculty to transition their courses into a Web-based environment they need to know not only their subject matter but also some principles of instruction and Web design as well as basic technology. Administrators have the challenge of making resources available to support the Web as a teaching tool. Staff require upgraded skills in order to fully provide the technical support required for Web-based instruction. Finally, students need to heed the following advice before enrolling in Web-based courses: 1) they need to be comfortable in using the technology, including the ability to surf the Internet; 2) a reassessment of time-management skills will be in order; and 3) a reevaluation of self-learning disposition will be necessary (Reid, 1997).

This paper will present the authors' experience in the development and delivery of an Internet-based, graduate level course. The focus is on four factors that impacted outcomes--student learning styles, students' knowledge of technology, instructional strategies utilized and course expectations of the instructor and students. Following a review of these factors, strategies that facilitate improved development and delivery of courses in this new learning environment are provided.

COURSE DEVELOPMENT AND DELIVERY

During the spring of 1997 the senior author agreed to teach "Learning Principles for Educators" over the Internet for a new university in southwest Florida. The instructor had taught this course four times previously over a three-year period. It is a survey course, focusing on major theoretical models of learning and their application in the classroom. The student population traditionally ranged from first semester graduate students to those in the final semester of a masters program. The class is required for many education majors and is an elective for most.

Following agreement to teach the class as an Internet-based course, the instructor was teamed with the co-author who served as instructional designer. It was his role to help move the course from the classroom to the Internet.

Several meetings occurred during the spring and early summer of 1997 between the instructor and designer to conceptualize course structure and outcomes and to develop assessment procedures. The course was finally conceptualized as a series of eleven independent modules that students would be required to complete. The on-line modules were designed to maintain consistency throughout the course to promote ease of navigation through materials by students. Each module contained lecture summaries, practice exercises, homework assignments and links to additional resources on the World Wide Web.

To promote interaction among students, an electronic bulletin board was maintained where students were required to post homework assignments, chapter summaries, and keyword definitions in an attempt to promote student interaction and remind them that they were not operating alone. The electronic bulletin board was also used by the instructor to disseminate necessary information such as clarification of homework assignments. E-mail was widely used by the instructor, and while all students had e-mail accounts, only about one-third of the students chose to communicate with the instructor directly using this medium. The course did not use synchronous Web-based communication tools.

Because the use of the Internet as an instructional medium was new, the instructor and designer agreed to hold two face-to-face meetings at the start of the semester to teach everyone the required software and to clarify expectations. A final full-day meeting was scheduled for a Saturday near the end of the semester for students to present research projects they had engaged in over the course of the semester.

At the start of the semester, 17 students had enrolled in the class. Scheduled to meet the first two weeks of the semester, only 14 students attended the first evening and one student attended neither of the two face-to-face meetings. Four students failed to complete the course and will not be discussed in the remainder of this paper. One additional student, who missed the first class, received an incomplete for the course.

Because of the small number of students who completed the course, none of the evaluation materials were analyzed using rigorous statistical procedures. Simple statistics are therefore offered to help demonstrate trends. The authors' understanding of the meaning of data will also be discussed.

MODERATORS OF OUTCOME

Student Learning Style

Speculating that student satisfaction would be related to individual learning styles, every student was administered the *Learning Styles Exercise*, adapted from Kiersy & Bates (1978). Based on the well-known *Myers-Briggs Type Indicator*, this assessment instrument is a self-administered questionnaire designed to quickly assign students a type code. It is assumed that students with a particular personality type will respond better to certain learning activities or environments.

Of the 13 students who completed this instrument, seven were identified as extroverts, with an 8th having a tie score between introversion and extroversion. This slight favoring for extroversion was a surprise and something of a concern to the instructor. Extroverts tend to prefer to operate in the world of people and things in a very interactive manner. Prior to the start of the class, the authors speculated that the extroverts were more likely to feel uneasy about their lack of interaction with others that is generally part of a face-to-face classroom experience.

The second type area focuses on the manner in which individuals obtain information. This is generally conceptualized as being either through sensing or through intuition. Those individuals who are sensing tend to be more practical, realistic, and fact based. Those who are intuitive tend to be good at finding new solutions or alternatives and value imagination. In this class, students were equally divided with six reporting themselves to be sensing, six reporting as intuitive, and one as a tie. Prior to the start of the course, the authors speculated that the intuitive learners would be more comfortable with the lack of hands-on and applied opportunities offered in this environment.

The third area assessed by type is the different ways of decision-making--thinking and feeling. Individuals who are reported to be thinkers tend to be logical and objective. These individuals also tend to have a preference for consistency and an appreciation for logical responses. Individuals who are identified as having feeling tendencies are sympathetic and appreciative of others. This group tends to be very concerned about the feelings and needs of those around them.

This class profile had a slight tendency toward feeling with eight students being identified as this type. Again, the authors speculated that “feeling” individuals might have a higher need for interaction with others and a need for immediate verbal and nonverbal feedback from the instructor and peers to help gauge their responses to assignments. Operating in a world constrained by text, this group of students might find it difficult to respond to online activities without being able to view their impact on others.

The final area assessed relates to the use of perception and judgment in dealing with the world. Judgers rely on an orderly process of judging the world and live in a planned fashion by attempting to regulate and control their world. Perceivers, on the other hand, rely mainly on a perceptive process and live in a more flexible and spontaneous way. They tend to be more concerned with understanding life and adapting to it.

In this class, ten students were found to have a tendency toward judging while two had a clear preference for perceiving. The final student tied on this dimension. The authors expected that students who were extroverted and judging would prefer to have matters settled. Also, they might prefer to be told what is expected of them in the classroom setting in very definite terms, then work toward these predefined behaviors.

This general trend for students to be extroverts and judging is in sharp contrast to the instructor who is an introvert and a high perceiver. These traits tend to lead to the instructor's style that values facts in relation to larger theories, and places a high premium on solutions, not "right answers." In general, perceivers are better at adapting to change and do not mind a lack of closure. They expect closure to come as a part of the process of moving forward. They also tend to be curious about alternatives and welcome new perspectives on old problems. This contrast may explain some differences in perceptions and expectations that occurred which may be more related to style than to the issue of using a new medium for learning.

Students' Knowledge of Technology

Students were asked to rate themselves on a 10-point scale. The ordinal 1 was labeled "phobic" and 10 was labeled as "addict." The result showed a majority of the students rating their knowledge of technology between 5 and 7.

Self-ranking was seen as a gross measure of student's self-perceptions but was not expected to accurately convey specific knowledge. Therefore, students were also asked to briefly describe their background and experience with computers and the Internet. All students reported some history with computers and in general identified a number of software packages with which they felt proficient. However, four students indicated that they had little or no experience with the Internet. The remaining seven described varying involvement with the Internet that was at least at the level of an occasional user, with some identifying daily use. While one-half of the students ranked themselves at 5 or above on their self-rating, six of 13 did not report a strong background in using or accessing the Internet.

Instructional Strategies

There was a genuine desire on the part of the instructor to take advantage of those features of the Internet that might enhance the delivery of course material in unique ways while improving learning. This proved to be the most difficult part of teaching in this new environment.

During course development, the instructor and instructional designer agreed on several principles that were important to be maintained in the course structure. These included:

A high level of interactivity and student sharing.

Assignments which required student thinking and processing of information.

Assignments which prompted students to read text materials prior to beginning new assignments.

A time structure that prompted students not to fall behind in their work.

An opportunity for students to meet one another at the start of the semester and to meet at the end of the semester to reconnect and learn from one another.

As specific course assignments were developed, some of these objectives were easily achieved, while others were more elusive. However, all proved to be valuable guiding principles in the development of the course and will be maintained as revisions are undertaken.

Expectations of Instructor and Students

Because few classes have been taught online at this university, it was anticipated that most students would enroll in the course with no previous experience in this medium. Therefore, student expectations were anticipated to be quite wide ranging with some maintaining a view very congruent with the instructor's, while others were expected to have very different expectations. This anticipated range of views was found.

One theme that emerged in students' expectations was that there would be less structure and more opportunity to work at their own pace. Many students expected that the course would be more akin to an independent study than to a structured course format. While such an approach is possible, it was determined that this would necessarily decrease the potential for student interaction. Anticipating that a large group of students would find the class more difficult without peer interaction, a high level of structure was maintained. Additionally, while several students expected large amounts of flexibility in the completion of assignments, the instructor's expectation of meeting weekly deadlines to ensure all students "kept up" was noted by some students to be helpful in completing the class.

As noted above, the amount of contact between students was an issue for both students and instructor. Many students clearly missed the sense of community and support that develops in a well functioning learning group.

Finally, the workload was a common theme discussed in student evaluations. Many students stated that the workload was too great or at least more than expected. Students may not have considered in advance the amount of time that would be spent online instead of in class. Students in this course generally have a high amount of independent reading and homework. However, it may be perceived as overwhelming when an additional four hours per week of computer time is added--time that replaces the four hours of in-class instruction.

RECOMMENDATIONS FOR IMPROVEMENT

As previously stated, the “guiding values” developed by the instructor and instructional designer were found to be beneficial and will be maintained. However, several additional recommendations can now be made based on the four areas discussed as moderators of outcome.

In relation to learning style, it is clear that a range of styles were present and that each may have individual instructional needs. The Internet provides an easy manner in which to respond to many of these. One recommendation based on this case study is that alternative versions of assignments be developed. These alternatives, while based around similar constructs, can be formatted slightly differently to allow students who desire a high level of specificity more direction and focus than students who choose to develop their own approach. Similarly, alternative sets of lecture materials can easily be hyperlinked to a single page, allowing students the opportunity to seek out materials that are at their level.

Students' knowledge of technology is and will remain an issue. Because technology changes so rapidly, students cannot be expected to maintain currency in all areas. Therefore, appropriate support needs to be provided for every technological strategy implemented. While a training session at the start of the semester was helpful, additional online documentation and tutorials would have provided additional needed support.

Institutions which maintain Internet-based courses need to have available support personnel who can answer specific questions about a variety of software packages, Internet service providers and the specific technology used in the class. When students become frustrated with the technology in their home they often need a human voice to help them sort through both their emotion and their difficulties.

Because the majority of students will do their work in solitude, assignments need to be constructed that the student can complete independently. However, these need to be balanced with an opportunity for students to interact with peers. Increasingly, synchronous communication packages are available in the market that are stable and support these interactive online activities.

Weekly meetings can be established using software packages where students, if they choose, can gather online to reconstruct relationships. This is an important way to meet the needs of extroverted students. Additional asynchronous tools such as electronic bulletin boards and e-mail can be used between these scheduled meetings to provide a steady level of support and communication.

Finally, expectations of the instructor must be carefully considered and communicated to the student. Most students today have limited experience with Internet-based learning and may develop expectations that are unrealistic. Others will anticipate an extremely high level of technology use that is unreasonable based on the average computing capacity of most students. Still others will expect all distance courses to be taught in a similar fashion and will judge each subsequent course against their first. By clearly communicating expectations, the instructor may not convince every student that the approach taken is the best. However, clear explanations will ensure that every student is an informed consumer of the approach undertaken.

CONCLUSIONS

This paper focused on the experience of a faculty member and an instructional designer in developing and delivering an Internet-based course. As a case study, the authors identified factors that impacted the experience of both instructor and students in this new learning environment by analyzing data collected during the course of the semester. Learning styles, knowledge of the technology, instructional strategies and expectations of students and instructor were described and discussed. Recommendations on how to improve the course development and delivery process for this kind of project were shared by the authors.

Finally, the authors identified several areas for future investigation concerning design and development of online courses. They believe that the relationship between learning styles and instructional strategies needs to be studied more. They also identified effective strategies in managing students' expectations and perceptions of this new learning environment as another area for study. By knowing how to prepare students either "virtually" or face-to-face and how to teach them about the technology's potential and limitations can make a big difference in their success in achieving the course outcomes.

Interactivity between and among students and faculty member is another area identified by the researchers for future study. The Web can become a static learning environment if interaction is not occurring between the learner, content, instructor or technology.

Finally, workload for faculty and students needs to be revisited. For faculty--*what is an acceptable teaching workload? What course enrollment number is acceptable, reasonable, and manageable? What incentives or rewards need to be given to faculty members who teach on-line courses?* For students, *what assignments are appropriate? What online support needs to be made available to students?* These questions provide the basis for much needed future research.

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LITERACY IN THE AGE OF INFORMATION OVERLOAD

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INTRODUCTION

Virtually no change in American society has presented greater challenges than the emergence of the "Information Age," the environment in which this and future generations will live and work. Dealing with the overabundance of information now routinely available seems at best overwhelming and at worst unmanageable and uncontainable.

In a 1992 speech to the faculty at California State University, James P. Appleberry, Executive Director of the American Association of State Colleges and Universities, observed,

> The sum total of humankind's knowledge doubled from 1790-1900. It doubled again from 1900-1950. It doubled again from 1950-1960, and again from 1960-1965. It has been estimated that the sum total of humankind's knowledge has doubled at least once every five years since then and that, by the year 2020, knowledge will double every 73 days!
>
> (Breivik and Jones, 1993, p. 24)

John Naisbett, prominent futurist and author, estimated that:

> ...information in the sciences doubles approximately every 5.5 years. This means that today's high school biology students have to cope with five times more information than their parents did when they were in high school.
>
> (Eisenburg & Spitzer, 1991, p. 115)

No longer can schooling alone be expected to supply students with all the facts they will need to know throughout their lives (Gee & Breivik, 1988).. Academic curricula cannot be revised often enough, nor expanded enough, to keep current with that rate of change. For students to be able to cope with this rising volume and be able to maintain a knowledgeable control over any significant portion of the information necessary to their personal and professional success, they must gain special skills and understanding, the acquisition of which is called *Information Literacy* (Rader, 1990).

DESCRIPTION OF THE STUDY

For the purposes of this project, *Information Literacy* was defined as the capacity to obtain and use information for a given need. It incorporates the abilities to: 1) recognize the need for information; 2) identify appropriate information resources; 3) devise a search strategy; 4) retrieve the information no matter where or how it is stored; 5) evaluate the information; and 6) use it appropriately (Burnheim, 1993). Only with these skills will today's students be able to participate fully in society and prosper in their work.

Tri-County Technical College has developed a three-level, curriculum-integrated model *Information Literacy* program designed to meet the needs of two-year degree and diploma students who are preparing for employment immediately after graduation. In this program, students learn to use the tools of research, to recognize quality, error and bias in information sources and to retrieve and use information in the context of the careers for which they are preparing.

Level One: Learning to Use the Tools of Research

Program level one is integrated into the first English course each student takes. Where students once freely chose the topic of their assigned research papers, they now choose from a list of 84 topics, developed by faculty and library staff together, which are more sophisticated than those typically selected in prior years.

The project librarian determined how well each topic was supported by the existing library collection and purchased additional materials as needed for adequate support. Development of the library collection included not only adequate *quantities* of information resources, but an appropriate mix of resource *types* (e.g., encyclopedias, almanacs, dictionaries, books and journals) and resource *media* (e.g., print, microform, electronic, and networked.) This development was intended to make certain, as far as possible, that each student gained essentially the same research experience, no matter which topic he or she chose.

In order to communicate the skills inherent in *Information Literacy*, the library staff developed a series of short workshops which students attended outside of class time. The workshops included:

Three Steps to Effective Research--which describes a three-step strategy which focuses on critical thinking skills to solve research problems.

Using Basic Reference Sources--instruction on how and why to use standard reference books including encyclopedias, dictionaries, atlases and almanacs, both general and specialized.

Using the Online Catalog--instruction on how to locate books and other library materials, both from the College's collection and at other libraries throughout the region.

Using Print and Electronic Indexes--instruction on how to search electronic indexes to periodicals with emphasis on constructing successful Boolean keyword queries.

Using the Internet and World Wide Web--which includes guidelines for when to use the Web, what it is and the types of information to be found, the differences between browsers and search engines and how to use search engines and how to evaluate and cite information gathered from Web sources.

Separate classes for faculty have been offered on a continuing basis. However, many chose to attend student sessions.

Level Two: Evaluating Quality, Error and Bias in Information Sources

The second level of the program is integrated into the second English course each student takes and into *HSS 105, Technology and Culture*. These skills are addressed in much the same way as Level One, i.e., students choose a topic from lists provided. The topics on that list were developed to create a structure which guaranteed that all students would receive substantially the same experience. The nature of those topics and their presentation forced consideration by the student of both sides of the issues covered.

The list of topics from which each student is permitted to choose varies, depending on the student's area of study. This is intended to introduce students to the professional journals and popular magazines related to their particular fields of study. Project librarians developed a sixth class, *Evaluating Information Sources*, to help students learn these skills.

Level Three: Career Skills

Within each of the College's technical curriculum programs there are a number of laboratory courses that provide excellent opportunities for creating exercises or activities designed to illustrate information resource requirements that may be encountered in that career field. Working with appropriate full-time or adjunct faculty from each curriculum, project staff developed activities that mirrored as closely as possible the circumstances students could expect to find on the job. Though there were many such opportunities within each curriculum, project time and funding limitations restricted faculty and project staff to the development of a single pilot activity for each curriculum. Several examples follow.

Business Management Technology. Though the Tri-County Technology College service area is rural and students have little experience with cultures other than their own, the three counties are home to a number of multi-national corporations as well as smaller companies which do business internationally. It is likely that these graduates may be called upon at some time to contribute in some way to efforts to introduce an employer's product into a foreign culture.

In this *Introduction to Business (BUS 101)* activity, each student selects a product or service and a country within a specified economic region (e.g., the European Common Market, the Pacific Rim Nations, or the NAFTA participant nations.) Using the World Wide Web and other library resources the student then considers the cultural, economic, and physical geography of the region/nation and identifies opportunities and problems inherent to the marketing of his or her own product in that region. Each student then writes a paper, which is graded, and gives a presentation to the class, which is not graded.

Textile Management Technology. Though a wide variety of manufacturers have located in the state, the textile industry remains South Carolina's largest employer. In today's textile environment, it is often necessary to be able to design various fiber combinations to meet purchaser's fabric specifications.

Students enrolled in *Fiber Science (TEX 201)* are assigned one of five possible scenarios from which to design fabric specifications. Fabric characteristics to be considered include strength, elasticity, moisture retention, color, texture, luster and others. Students work in teams of four to research possible fiber combinations to meet the specifications, using the *Textile Technology Digest,* additional professional materials, and the World Wide Web. Each team submits a written proposal and makes a formal presentation to the class.

FINDINGS

Level One Results

Based on a statistical analysis of the data from pre-and post-tests on various aspects of *Information Literacy*, the following statements can be made about students at the end of the period: 1) they used more sources for their references; 2) they used a greater variety of sources; 3) they used more types of references; 4) they used more as well as more current references; 5) they used references that were more suitable to the topics; and 6) they spent more hours in the library on assignments.

Level Two Results

Evaluation of the second level of the program indicated a 13.6 percent increase between the pre- and post-test abilities of the students to identify characteristics of information resources which describe their quality and potential usefulness for a particular information need.

Level Three Results

At this writing, approximately two-thirds of the technical curricula have completed implementation and evaluation of the activities identified. This was the only portion of the project in which significant changes were made to course syllabi, but there were not enough students in any curriculum program to provide a control group of meaningful size. Therefore, the data collected from students were self-reported, though it was reinforced by faculty observation.

Preliminary data analysis indicates that overall, students overwhelmingly tended to "agree" or "strongly agree" that the activities in the courses were beneficial. There were variations in the level of student agreement among the courses. Faculty showed a stronger agreement that the activities were beneficial than did the students. Additional information about project results can be found at <http://www.appnet.org/infolit>.

CONCLUSIONS AND RECOMMENDATIONS

Project staff believe the more closely librarians work with faculty in developing library assignments, the better they can support student research with collection development, instruction, and personal assistance. Library funds are spent more effectively and circulation and student satisfaction increase because students can locate the materials they need.

Through the Level Three activities, technical curriculum students, not traditionally library oriented, discovered that the library was not a purely academic environment and they could find practical information which could positively improve the quality of their careers and personal lives. The project staff recommend that colleges consider the implementation of an *Information Literacy* program appropriate to its students and their particular needs.

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ONGOING ASSESSMENT OF THE USE OF SELF PACED COMPUTER-ASSISTED LEARNING MODULES IN MUSIC APPRECIATION

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INTRODUCTION

An important goal in a music appreciation course is the development of musical responsiveness. While study of the printed score and learning the history of composers and their works are valuable activities for young musicians, the experiences that most often develop musical and aesthetic understanding center upon either listening to a performance or participating in a performance. Responsiveness is enhanced to the extent that students are provided guided experiences in listening to music. A music appreciation course, then, is obliged to help students identify musical elements such as melody and harmony and to understand the use of these elements in a musical context. Musical growth requires a focus on auditory discrimination and analysis, not merely musical gymnastics or organizations.

Musical responsiveness develops at widely varying rates among students in general education courses--such as that involved in the present study--due to the fact that the level of ability and the amount of previous experience with music varies extensively. Development of responsiveness may certainly be aided by broad availability of musical experience and even further assisted when these experiences are mediated in some manner. These factors suggest that students who need more time acquiring listening skills must have access to some form of instruction outside class time.

Computer-assisted instruction (CAI) has long been used for supplementary instruction. In music education, CAI has found its greatest success in development of skills in the areas of theory, sight-singing and ear-training. While these uses are both valid and extremely valuable, they tend to remove music from its context as a performance medium.

One means of incorporating computer-assisted instruction is through the presentation of modules which preserve the performance context, while allowing students to master content at their own rates and in settings other than the traditional classroom. In this context, modules may be defined as small bits of information that, taken as a whole, provide greater understanding of a specific concept. This paper reports the use of interactive modules which provided information in a multimedia fashion, then tested students' comprehension of the concepts outlined.

DESCRIPTION OF THE METHOD

Subjects

Subjects were students enrolled in a music appreciation section at *Northwest Missouri State University* during fall and spring semesters, 1997/98. The music appreciation course is a general studies option in various degrees at the university; students, therefore, came from a variety of disciplinary backgrounds.

Design

Students were offered extra credit as an incentive to complete the unit listening exams. In addition, they were informed that their performance on the unit tests taken in class would benefit from this activity. Five computer-administered tutorial modules were provided for each unit to help students gain necessary skills to pass the tests.

Effectiveness of learning modules was measured by comparing scores on the listening portion of unit exams taken in class. Students who elected to complete the corresponding computer-administered exam and scored at 85% or higher were placed in Group I. All other students were placed in group II. Mean scores of the groups on the class-administered exams were compared through the use of t-tests.

Materials

Course content was divided into five units, which were then divided into five smaller segments called modules. The primary focus of the modules was to develop the aural concepts discussed in the course text, *The Enjoyment of Music* (Machlis and Forney, 1995). The capability of today's computers to present graphics and sound in an interactive setting provided an ideal environment to create tutorials that addressed aural concepts.

The tutorials were designed using *PODIUM* (Hofstetter. 1997) software. This software facilitates the creation of hyperlinks much in the way that HTML functions in World Wide Web documents. Multimedia objects such as pictures, music, movies and audio clips were embedded in tutorial screens or linked to buttons and text. In addition, the software provided the opportunity to generate and score tests. Finally, it provided the networking capability required to administer this project.

Hardware required for the presentation of these modules included an IBM-compatible computer with a CD-ROM drive running Windows 95. Tutorials were designed to use the campus local area network (LAN). The students living on campus had computers in their residence hall rooms that were connected to the LAN; other students could use computers in the library or computer labs on campus. Students were required to have a copy of the run-time version of *PODIUM* on their computer or on a floppy disk in order to access the modules and tests.

During the spring semester, versions of the tutorial modules and tests were made available on the campus Web server for students who were commuters and who had Internet access. A set of compact discs containing the musical compositions studied was issued to each student.

The modular learning project provided the student with two options. The first was to access tutorial modules to facilitate the acquisition of listening skills and the second was to take unit tests over listening objectives. Generally, each unit test combined questions from all five tutorial modules found in that unit.

Each module contained three parts. The first was a set of tutorials which provided information and musical examples appropriate to selected concepts. The second was a short quiz which tested students' comprehension of that module, and the third was a screen which provided the results of the module quiz. In addition to a record of scores, this screen provided access to the data generated when quiz items were missed.

FINDINGS

Data for the two semesters are presented in Tables 1 and 2. These tables provide a comparison of the mean scores of Groups I and II on the class-administered examinations. Data for the two semesters were analyzed separately since the course was still in progress at the time of the writing of this paper, and scores for units three, four and five were not available.

Table 1. Summary of t-test Results Comparing Mean Scores on Class-Administered Exams to Groups I and II, Fall, 1997

Exam	Group	n	M	SD	df	t	p
1	1	7	11.71	1.80	45	3.055*	<.0038
	2	40	9.35	1.90			
2	1	14	12.86	1.66	44	5.8978	<.0001
	2	32	7.59	3.14			
3	1	15	12.87	1.51	42	3.527*	<.0002
	2	29	10.41	2.46			
4	1	17	13.41	1.62	40	5.723*	<.0001
	2	25	8.60	3.19			
5	1	15	14.46	0.64	44	6.119*	<.0001
	2	31	9.10	3.35			

Table 2. Summary of t-test Results Comparing Mean Scores of Class-Administered Exams to Groups I and II, Spring, 1998

Exam	Group	n	M	SD	df	t	p
1	1	13	9.77	3.19	37	-0.438	<.6642
	2	26	10.15	2.24			
2	1	8	12.75	2.49	37	5.268*	<.0000
	2	31	6.87	2.88			

CONCLUSIONS

Evaluation of the data offers an indication that student test performance is substantially enhanced by the completion of the modules. While some students were capable of achieving high test scores without completion of the modules, many students who did not complete the modules scored very poorly on the unit exam. Conversely, among those students who completed the modules, few failed the listening portion of the related unit exams.

Numerous benefits of the use of such computer-assisted modules were identified through this study and appear to have been validated in the results of the study, at least to the extent that an improvement in test scores may be accepted as validation. The modules permit students to complete listening and study activities at any convenient time and away from the confines of the classroom.

Self-pacing of the modules is an important aspect of the study. Students who gained an understanding of a particular concept more quickly were free to move on to other units. Those who needed more time and additional trials to grasp the concepts were provided an opportunity to master them. This mastery-level approach to the musical concepts found in the modules and the mediation offered in each module are thought to be major reasons for the improvement in test scores among those students who had successfully completed the modules.

An additional benefit identified through the study is the opportunity to incorporate many media in presentation of the material in the modules. The extensive and increasing capabilities of computer-assisted Instruction, especially as seen through the use of *PODIUM* authoring software, provide an active, dynamic learning environment. While the present study made use of interactive screens and incorporated GIF, MIDI and even MPEG files, the potential for further development in this line is extensive. The ability to link learning modules directly to specific Web sites, while not in the study to this point, offers unlimited possibilities in structuring learning modules for students.

Several questions may also be raised as a result of these findings. The issue of mediation in learning has considerable currency. In this study, it is difficult to determine whether the mediation offered in the modules was directly responsible for the improvement in test scores. It is conceivable that repeated exposure to musical examples, without mediation, may produce an improvement in test scores as well. The level of improvement directly attributable to mediation is uncertain.

Additionally, in these early stages of the study, the number of students involved in both groups was small. Further evaluation of the process will offer larger numbers which will increase the level of confidence in the findings.

There is also a question of self-fulfilling prophecy. Since no measure of students' incoming ability levels was available, the possibility cannot be ignored that those students with a greater musical aptitude and background may have comprised the bulk of those completing the modules.

Student motivation to complete the modules is also an important consideration in evaluation of the study. It is legitimate to ask whether those students motivated to complete the modular units may not have also been those to score more highly on the unit exams without the benefit of the modules.

There is little question that the level of incoming knowledge is a factor in at least the initial unit of the set. Results indicated a less clearly defined difference in unit one test scores of those students who had completed the module and those who had not. Since this module deals primarily with the elements of music, it is thought that prior knowledge may have had a greater impact in this unit. Music education programs at most secondary schools are structured to develop this sort of understanding and do not provide extensive information concerning the concepts outlined in units two through five of the set.

If student selection of specific sections of the course may be considered a form of randomization, the question of motivation may be addressed to an extent. With the presumption that motivation level among specific groups of students remains fairly constant, it may be expected that the number of students with high scores among the different sections of the course would be similar. The study makes plain the fact that modularized instruction led to stronger test scores for a significantly greater number of students; the solid implication is that this tool is a valuable aid to classroom instruction.

An isolated incident during the second semester of test administration raised the issue of integrity with regard to modular instruction. In one instance a student scored quite well on modular tests, but failed the written unit exam very badly. Since no monitoring of students is possible when they are completing the modules and in consideration of the fact that in all other instances there was a strong correlation between module tests and written unit exams, the question of student integrity must be considered. While no immediate solution to this problem is offered here, the question itself appears to strongly suggest that modules should not form the only basis for student assessment or for assignment of course grades.

Finally, there is an issue of what portions or aspects of a course may be amenable to this sort of modular instruction. Some types of information may not be as appropriate for modularization as are the listening examples included in this study. Additionally, mediation offered through modules will always be more limited than that available in personal interaction with an instructor. For these reasons, it is not suggested as a result of this work that the modules replace classroom instruction but that they be used to enhance that instruction and increase the potential for student success in the course.

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CLASSIC SYSTEMS, CURRENT INSIGHTS: TECHNOLOGY UNPLUGGED

Annette Wyandotte
Indiana University Southeast

INTRODUCTION

Moderns take for granted that the term "technology" assumes something electronic, if not cybernetic. The word is applied to the newest high speed computer processors, the research behind electronic tissue imaging and the systems that can identify a customer at an ATM simply with the scan of an eyeball. However, it is important to remember that human beings discovered ways to systematize the world around them even before inventing writing. This, after all, is a forgotten meaning of technology: the creation of systems that assist human beings to understand and control the environment. The Greek word "technologia" fuses two practical roots: "logia"-- study of; and "techne"--craft or skills. By extension, a "technology" is a systematic treatment of knowledge.

Technologies exist to make the unfamiliar familiar, the ambiguous distinct and the overwhelming manageable. Technologies allow learners to take something new or foreign and to then adapt that concept to something already familiar or comfortable. Therefore, by this definition, the notion drops away that technologies need to be cutting edge, high speed or plugged in. In fact, some of the most effective technologies for the classroom are "unplugged" and as old as civilization. It is this category of technology which can be used to advantage in a small, under funded, regional college classroom with the same benefit it is used in a top ten university lecture hall.

CLASSIC TECHNOLOGIES USEFUL IN LEARNING

While the hunt for these grass roots technologies can be quite time consuming, some ancient technologies are readily available for use in the classroom. These are qualified by their propensity for quick assimilation and immediate application to difficult classroom material. Two technologies which satisfy these criteria are the enneagram and human archetypes.

The Enneagram

The enneagram is an ancient Sufi system whose name means "picture of nine," reflecting nine points, or personality types, depicted in depth to the learner. Students can identify their own learning styles from the enneagram's descriptions. Among other features, each style (or "type") differs in a preferential focus of attention, method of selecting information, personal "blind spot," and approach to stress management.

The enneagram is a rich and detailed theory with many facets and applications to warrant years of study. However, one such application will be highlighted here so that readers can imagine its myriad possibilities for the classroom--such as the one delineated in Learning and the Enneagram's newsletter *Talking Points* (Levine, personal communication, 1996) in which Wyandotte (1997) demonstrates the enneagram's value in a case study for an undergraduate business writing course.

As director of West Medical Clinic, students are asked to write a job acceptance letter as their first act. Immediately they are introduced to the clinic's nine key personnel whose fictional profiles are patterned after the enneagram's nine points. To re-establish the clinic's tarnished reputation, the directors (students) are invited to implement a quality-oriented management style and to build a functional team of its principal employees. As they study management in terms of the enneagram, "directors" use business writing to implement their program.

While the concepts of quality management unfold, students begin to see how their communications are interpreted differently by each enneagram type in their "audience" of key personnel. They also learn that their sensitivity to audience is critical to being successful managers and written communicators. Successive assignments help these student "managers" to learn more about their own style in relation to others whom they wish to influence and inform through their writing.

Applying the enneagram to business, writers become adept at "speaking the language" of their own employees. Burke (1969) has called this technology *rhetoric*, a study of how human beings use words to shape attitudes and to induce behaviors in other human beings. Wisely, Burke has rooted persuasion in the process of "identification." Similarly, writers also work to identify with readers through understanding personality differences. Group discussion, peer review and instructor feedback all assist in building the technology of the enneagram within the learner so that the key elements of successful business communication become as familiar as oneself and those with whom one is closely connected.

Archetypal Theory

Human archetypal theory is another primitive technology--in fact, Jung (Singer, 1994) believed it to be as old as human consciousness--which brings students insight into characters' behaviors and motivations, accessing for them a universal human process. *Six Archetypes We Live By* (Pearson, 1994) has identified a manageable archetype technology, fit for lower-level literature study. Like the enneagram, archetypes can be addressed with greater complexity as one advances. While they provide a recognized approach to literary criticism, their use appears to be a largely untapped area in general studies reading courses. Yet this device has been used successfully to interest freshmen in the study of classical world literature.

The six archetypes applied in this context represent a progression of psychological themes, human dilemmas, and approaches to the world that are shared both by students in their own lives and by characters in all periods of literature--the innocent, orphan, martyr, wanderer, warrior, and magician. As a bridge between learner and the literary character being studied, archetypes collapse the normal boundaries of history, culture and "other-ness" that often prevent students from seeing themselves in the characters, as differences dissolve into universality.

Completing Pearson's archetypal survey early on and journaling about their own lives in terms of archetypes, students study literary selections arranged in archetypical progression and eventually write course papers linking the two. Critiquing literature through archetypes makes the works more meaningful and exciting as it awakens students' sense of self-discovery.

More over, instructors grow excited to see readers recognizing how archetypal images themselves speak the language of cultures and ages being studied. For example, Singer (1994) has observed that while archetypal forms remain constant, their content changes historically. Odysseus enacts the warrior archetype quite differently than Norman Schwartzkoff. In sequencing the curriculum to show these variations on the same theme, the instructor makes accessible two paradoxical truths about the human condition--human beings are both all alike and all distinct. This technology is powerful, however, not according to whether one believes in archetypes but according to whether imagining them to exist enables learners to conceptualize literature better as a result, even as the literature then enables readers to organize their life experiences more meaningfully. The particular curriculum of a second semester survey course in world literature illustrates this process. The works below have been anthologized by Wilke and Hurt (1997).

The Innocent. Contrasting "The Innocent" archetype with that of "The Orphan," and retaining the historical periods of the anthology as a sub-structure, readers study Moliere's *Tartuffe*, Swift's *Gulliver's Travels*, Blake's *Songs of Innocence,* Freud's *Dora*, Conrad's *Heart of Darkness* and Faulkner's *Odor of Verbena.* Examining the fall from innocence as a shared theme, these works portray how the natural consequence of this fall evokes multiple conflicts--desiring safety and nurturing yet fearing abandonment and chaos, thereby highlighting the relationship of self to authority.

The Orphan. Next, the study examines three responses to orphanage. These three reactions show how human beings cope with a fallen state. Martyrs rely on self-sacrifice-- Ozick's *The Shawl*, Doestoevsky's *The Grand Inquisitor* and Lawrence's *Odor of Chrysanthemums.* Wanderers seek autonomy--Wright's *Big Boy Leaves Home*, Ibsen's *A Doll's House* and Woolf's *A Room of One's Own.* Warriors attempt to become self-assertive-- Swift's *A Modest Proposal*, Sartre's *The Wall* and Eliot's *Love Song of J. Alfred Prufrock.*

The Magicians. The semester ends with the magicians--Tolstoy's *The Death of Ivan Ilyitch* and Douglass's *Narrative of the Life of Frederick Douglass,* to bring the study full circle. Magicians seek authenticity, wholeness, and balance. Healing the wounds of separateness, they return to innocence, assured by a new vision. Knowing that they are like and unlike others, they let go of illusion, to embrace the sacred in all of life.

In addition to building conceptual bridges across barriers of time and space that may otherwise separate students from the content studied, the enneagram and the archetype evolve a consciousness of diversity, as well, by simultaneously revealing differences and similarities in others, directly and in depth. In business writing, the enneagram assists learners to communicate more effectively as managers with their coworkers, tactfully confronting foibles and developing strengths to achieve a goal cooperatively.

In literature, archetypes enable young readers to recognize and appreciate both the flow and the "stuck-ness" that human beings experience at various life stages. Together, both tools suggest to students that human beings all dwell in the same psychological and environmental nest and that how they sit in that nest may be at once individual and predictable. Burke (1984) has noted that it is through constructing schemas that human beings find their way through an ever-changing environment. These "unplugged" schemes enable students to know themselves and others, to better contribute to their world.

One world literature mid-term examination has captured this new vision aptly:

> I am beginning to learn the value of the human spirit. It takes awhile to get over the childishness of needing to possess material things to realize that a life filled with passion, empathy, and heart is better. As I get further along in life, the holes in my soul that were never filled by clothes or cars are made whole again by the experience of sharing my life with others. Dostoevsky shows us this when his Grand Inquisitor recognizes that the secret of man's being is not only to live, but to have something to live for.
>
> A. Lockman

CONCLUSIONS

Many benefits flow from taking advantage of unplugged technologies like the enneagram and the archetype. They require only a trip to the bookstore and a few hours' labor. Figuring out how they apply to subject matter and personal experience is fun for instructors and students alike. As one class member reported anonymously on a recent course evaluation:

> I don't normally like literature, but (this course) showed me a new side of it and how to see it in my own relations

Another student said:

> I like how this course made (clear) the relation to my own life. I have a deeper understanding of myself because of it.

Not only are these wireless technologies virtually cost-free, inspirational and revelatory, but they also contribute painlessly to students' critical thinking skills. In nurturing the analytical processes needed to understand and apply them to literature and to life, the enneagram and the archetype move students beneath the surface level of learning, making it more likely that the material to which they apply may have a lasting impact. Significantly, then, they provide more than intrinsic motivation and active participation--as students connect new to old knowledge, they discover themselves.

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AWARDS

for

INNOVATIVE EXCELLENCE

in

TEACHING, LEARNING

AND TECHNOLOGY

The *Ninth International Conference on College Teaching and Learning* provided the opportunity for colleges and universities throughout the world to nominate a faculty member to represent their institution and to receive an *Award for Innovative Excellence in Teaching, Learning and Technology*. A common standard was provided, with the premise that nominees had contributed in highly creative ways to teaching and learning, with emphasis on the uses of innovative learning strategies (such as cooperative and inquiry learning) combined with technology. Within this broad spectrum each institution developed its own criteria and conducted an institution-wide search, with the final selection endorsed by the President or Provost.

Faculty nominations were received throughout fall and winter of 1997/98. A total of 52 higher education institutions nominated faculty and the nominees received the awards in a special ceremony during the 1998 conference.

The names of the faculty receiving the awards, their pictures and the names of the nominating institutions are provided on the following pages. Brief summaries of each individual's creative contributions which led to their nominations have also been included.

AWARD FOR INNOVATIVE EXCELLENCE IN TEACHING, LEARNING AND TECHNOLOGY

Marc J. Barr
Associate Professor,
Radio, Television & Photography
Middle Tennessee State University
Murfreesboro, Tennessee

Technology is an integral part of Barr's digital animation courses. He has shared his expertise with faculty, students and K-12 audiences through numerous presentations and publications. He is also the Director of Education for SIGGRAPH.

Elwyn Bellis
Professor, Physics
Marshall University
Huntington, West Virginia

Bellis developed a microcomputer-based Introductory Physics lab in 1996 and began teaching Workshop Physics, an activity-based General Physics course with no formal lectures, in 1997. He collaborated in development of the first integrated science course at Marshall University.

Tyra Benoit
Instructor, History
Butte College
Oroville, California

Benoit introduced two survey courses at Butte College in Western Civilization. She is involved with the Chico Peace and Justice Center, the Newman Center, the City of Chico and the Chico Unified School District. She also is director of the Maestros Program at Butte College.

Elroy J. Bolduc
Professor Emeritus,
Education
University of Florida
Gainesville, Florida

Bolduc was a developer of the first "computer literacy" course at the University of Florida. He has developed courses on interactive video and on uses of computers in mathematics and science. He currently teaches a course on Web publishing for honors students.

Anthony K. Byrd
Assistant Professor, Finance
University of Central Florida
Orlando, Florida

Byrd's teaching methodology incorporates teamwork exercises, multimedia presentations, the Internet and smaller break-out workshop sessions. He has published finance education research in *Financial Practice and Education*, the *Journal of Educational Media*, and the *Journal of Financial Education.*

Merry A. Carter
Professor of Medical Laboratory Technology
& Program Director, Histotechnology
Florida Community College at Jacksonville
Jacksonville, Florida

Carter is designing an online component of the Histologic Technology Program at Florida Community College at Jacksonville which will enable students throughout Florida to complete requirements for licensing. FCCJ is the only institution in the state that offers the accredited A.S. Histologic Technology program.

Gloria Clark
Associate Professor, Accounting
Winston-Salem State University
Winston-Salem, North Carolina

Clark is a Certified Public Accountant in the state of North Carolina and serves on the board of directors of the Summitt House of the Piedmont. She has incorporated the Cyberenvirons instructional delivery tool into her accounting courses to create a virtual business reality for otherwise-challenged students.

Venera Mihaela Cojocariu
Lecturer, Sciences of Education
University of Bacau
Bacau, Romania

Cojocariu is a graduate of the University of Bucharest. She spent 10 years as teacher of social sciences at the secondary school. She is trainer for a doctor's degree in Science of Education.

Charles Croll
Professor, Psychology
Broome Community College
Binghamton, New York

Croll is creator of two different pedagogical approaches to teaching Introduction to Psychology: a video format and an Internet format. Croll has also conducted research on reality and fantasy development in children and on cognitive processing of concepts.

Michael D. DeMichele
Professor & Chair,
History
University of Scranton
Scranton, Pennsylvania

DeMichele is author of *The Italian Experience in America* and numerous articles and papers on ethnic European and British history. He has integrated multimedia into other techniques, including field trips and overseas study, into his history courses.

David B. Downing
Professor, English
Indiana University of Pennsylvania
Indiana, Pennsylvania

Downing edits the journal, *Works and Days*, and has edited or co-edited three books and published numerous articles. He has taught undergraduate and graduate courses in writing, literature, critical theory, cultural studies and electronic pedagogy.

David L. Elliott
Coordinator, Cultural
& Historical Studies
SUNY Empire State College
Saratoga Springs, New York

Elliott coordinates the cultural and historical areas of study for distance learning course development for the Center for Distance and is a faculty mentor. He is also editor of an international Internet mailing list for historical demography and has served as a faculty consultant in educational technology.

J.D. Eveland
Professor,
Organizational Psychology
California School of Professional
Psychology — Los Angeles
Alhambra, California

Eveland has pioneered the use of Web-based course materials at California School of Professional Psychology. His interests involve utilization of new management technologies in the improvement of organizations and the impact of computer-mediated communications.

J. Bruce Francis
President
The Graduate School of America
Minneapolis, Minnesota

Francis is an avid promoter of innovative educational methods and has broad-based knowledge of the use of computers in education. Prior to joining The Graduate School of America, he was president of the Saybrook Institute, a distance-learning graduate school.

Herbert Friese
Associate Professor,
Criminal Justice
Burlington County College
Pemberton, New Jersey

Friese has introduced computer-based quantitative analysis components into his criminal justice course at Burlington County College. He previously taught at John Jay College, where he was a principal architect of the criminal justice curriculum used by most colleges.

Manuel Jesus Garcia Garrido
Professor, Law
Universidad Nacional
de Educacion a Distancia
Madrid, Spain

Garrido is one of the founding members of a group that guided incorporation of new technology into the educational model at Universidad Nacional de Educacion a Distancia in Madrid.

Gillian Gwynne
Lecturer, Psychology
& Coordinator,
Context Curriculum
Royal Melbourne
Institute of Technology
Melbourne, Victoria, Australia

Gwynne has been instrumental in the examination and evaluation of online teaching and learning within the Royal Melbourne Institute of Technology. She and colleague Andrea Chester have conceptualized and developed an innovative subject in which students interact via aliases to explore the issues of identity and community online.

Lilia Reyes Herrera
Associate Professor, Science
Universidad Pedagogica
Nacional—Colombia
Santa Fe de Bogota, Columbia

Herrera, an associate professor at the Universidad Pedagogica Nacional in Colombia, is currently conducting research on teachers' epistemologies and researching teaching methods for the university's new doctoral program.

Charles Hiatt
Instructor,
Economics & Business
Central Florida Community College
Ocala, Florida

Hiatt created and taught the first online course in economics at Central Florida Community College. He has also created an electronic classroom through the use of interactive, animated CD-ROMs and classroom presentations that incorporate motion and sound effects.

Bill Hunter
Assistant Professor,
English & Theatre Arts
Edinboro University of Pennsylvania
Edinboro, Pennsylvania

Hunter teaches Multi-Ethnic American Literature at Edinboro University of Pennsylvania. He has published in *Nineteenth Century Studies* and *The Journal of Popular Culture*.

Zhonghong Jiang
Assistant Professor,
Mathematics Education
& Computer Education
Florida International University
Miami, Florida

Jiang is heavily involved in research and grant activities. His research and publications center on the use of technology in mathematics teaching and learning.

Igor Kabashkin
Professor, Aviation Systems
Riga Aviation University
Riga, Latvia

Kabashkin is author of 217 scientific papers and 19 scientific and teaching books in Operations Research, Information Technology, Electronics and Telecommunication. He is a member of the International Telecommunication Academy, the Baltic Operation Research Society and the IEEE Computer Society.

Bruno Kappes
Professor, Psychology
University of Alaska Anchorage
Anchorage, Alaska

Kappes teaches in three departments at University of Alaska Anchorage: psychology, biomedical and distance education. He also serves as director of the Psychological Services Center. His lectures are enhanced by incorporation of visual aids consisting of computer-generated graphics, some with animation.

William Kemler
Professor, Psychology
Lincoln Land Community College
Sprinfield, Illinois

Kemler helped develop a computer-assisted course for Introductory Psychology that included both physical design of the classroom and content development. The focus of the course has evolved into a skill-based orientation that emphasizes critical thinking and the evaluation of psychological information.

Andrew J. Kuntzman
Associate Professor, Anatomy
Wright State University
Dayton, Ohio

Over the past two years, Kuntzman's lectures have evolved from use of overhead transparencies to multimedia presentations. The histologic component of the course has evolved from the use of 2x2 slides to videotape to the Web. Student retention over that period has improved from 66 percent to 75 percent.

Christo Lassiter
Professor, College of Law
University of Cincinnati
Cincinnati, Ohio

Lassiter utilizes a creative use of the problem method in teaching law by exploring criminal themes from classical literature. He developed an innovative computer outline of 4th Amendment case law that integrates learning with practice methods.

Donald Kenneth Maas
Professor, Education
California Polytechnic State University
San Luis Obispo, California

Maas, a recipient of the Distinguished Teaching Award, has been honored by Phi Delta Kappa International to conduct a series of workshops on teacher effectiveness throughout the world.

Diana Martelly
Chair, Mathematics
& Natural Science
Miami-Dade Community College
Homestead, Florida

Martelly is currently conducting research on the effects of using manipulative materials to teach remedial mathematics to college students. She has effectively implemented the use of several teaching/learning strategies in the Mathematics Department at Miami-Dade Community College — Homestead Campus.

Jonathan Matte
Instructor, Mathematics
Sacred Heart University
Fairfield, Connecticut

Matte has exhibited extraordinary talents in the teaching of mathematics to the liberal arts student. Without sacrificing mathematical rigor and preciseness, he has been able to instill in the student an appreciation of the subject through the use of unique problem-solving techniques in his Probability and Statistics course.

John F. Moore
Director, Educational Technologies
Virginia Polytechnic Institute
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Moore manages the Faculty Development Institute in Blacksburg and provides leadership for curriculum development and asynchronous learning projects. He recently co-directed a Sloan Foundation grant to develop and assess asynchronous courses.

Holly Morris
Associate Professor, Biology
Lehigh Carbon Community College
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Morris, who has taught at Lehigh Carbon Community College since 1989, also spent 15 years in basic medical research at Children's Hospital in Philadelphia, the University of Illinois and the University of Pittsburgh.

Matthew J. Pantera
Chair, Recreation & Leisure Services
Springfield College
Springfield, Massachusetts

Prior to joining the faculty at Springfield College, Pantera managed national award-winning municipal agencies. He also worked for the Buffalo Bills and NBC. Pantera was recognized as "Citizen of the Year" for Brookline, Mass. and as "Professional of the Year" by the 13-state Northeast Region.

Farrell G. Patrick
Professor, Information Systems
Pace University
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Patricks' research interests include multimedia, Web page applications and Excel cash flow business models. He is the author of Pace University's popular multimedia course that introduces students to the Internet and to advanced technology subjects. He also has been instrumental in obtaining grants and organizing the multimedia laboratory.

Michelle Pellillo
Assistant Professor, English
& Director, Writing Center
Bluefield College
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Pellillo's primary areas of expertise are composition and writing center administration. Her achievements at Bluefield College include obtaining grants to establish an English computer lab and a traditional and electronic writing center. She also is a recipient of the Distinguished Faculty Award.

Alberto Ortiz Prieto
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Prieto is also professor in Workshop Design at Universidad Particular de Chiclayo. He was elected dean of the Architecture School in 1995 and was named president in 1997. He is a past president of the Young Association of Entrepreneurs of Chiclayo and was designer on several buildings in the city.

Enrique Tello Roldan
President
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Roldan is senior lecturer of Universal History Pedagogy and of History of Argentine Education. He was elected president of Universidad Nacional de La Rioja in 1992. President Menem of Argentina presented him with the Jose Balseiro Award in 1997 for his program "Applied Research for Development."

Enrique Ballester Sarrias
Director, Engineering School
Universidad Politecnica de Valencia
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Sarrias has written 24 articles, including Innovation Within Engineering, and is author of several multimedia applications for the teaching of engineering. He is also a member of the European Conference in Vocational Training.

Karen L. Schwitters
Instructor, Mathematics
Seminole Community College
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Schwitters instituted multimedia instruction to the intermediate algebra course at Seminole Community College. She planned the new 29-workstation computer classroom, trained other faculty to teach the course, wrote a standardized test bank for all sections to use and developed the curriculum to meet the existing course outline.

Michael P. Smith
Associate Professor, Education
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University of North Florida
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Smith developed a technology-rich, museum-based education methods course that emphasizes the value of community services. He teaches the course at the Cummer Museum in Jacksonville. Students enrolled in the course have the opportunity to visit museums and museum education departments in London and Paris.

David Sonnenschein
Associate Professor
& Chair, Music
Northeastern University
Boston, Massachusetts

Sonnenschein's 40-year career as conductor, educator and composer is based on experiences gathered on three continents. He is author of *The Anatomy of Music*. More recently, he immersed his creativity in the development of multimedia programs for teaching music cognition to the non-major in music.

Susan Stoney
Lecturer, Management
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Stoney has research interests in interface design and the design of multimedia to motivate and engage adult learners. She is working with members of the business faculty to redesign courses for electronic preservation and transmission.

Janice A. Stoudemire
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Over the past 12 years, Stoudemire's commitment to teaching excellence and innovation has been recognized by several significant teaching awards, including Governor's Distinguished Professor, AACT Excellence Award — Southern Region, Outstanding Accounting Educator — SCACPA and Faculty of the Year at Midlands Technical College.

Gerald C. Swanson
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Swanson pioneered CBI authoring at Daytona Beach Community College, using Icon Author to develop drill and practice programs for Introduction to Chemistry students. He authored a Laboratory Manual for Introductory Chemistry published by McGraw-Hill and authored a manual of Home Experiments for Introduction to Chemistry.

Andrzej Syszko-Bohusz
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Cracow, Poland

Syszko-Bohusz is inventor of a new branch of pedagogy, Holistic Pedagogy, and is author of approximately 100 interdisciplinary dissertations, essays and articles on pedagogy, psychology, and comparative religion.

Jay C. Thompson, Jr.
Professor, Educational Leadership
Ball State University
Muncie, Indiana

Thompson developed the class page for television courses offered through Ball State University for classroom teachers and school administrators. This technology is also used in his campus classes.

Florin Topoliceanu
Professor & Dean of the Faculty,
Medical Bioengineering
University "Grigore T. Popa"
of Medicine and Pharmacy, Iasi
Iasi, Romania

Topoliceanu's research interests on the effects of multimedia educational interactive technologies in teaching medical bioengineering disciplines have helped him improve both student achievement and inter-group relationships in the faculty classes.

Normal R. Tyler
Director, Urban & Regional Planning Program
Eastern Michigan University
Ypsilanti, Michigan

This year, Tyler taught Eastern Michigan University's first online course, Historic Preservation, which incorporates an interactive downtown planning simulation. He is author of Issues of Historic Preservation and is now writing an Internet-based textbook on downtown revitalization.

Kenneth L. Verosub
Director, Davis Honors Challenge
University of California, Davis
Davis, California

Verosub directs an honors program at the University of California, Davis, that uses collaborative learning and real-world problems to prepare students for the challenges they will face in their careers. He is currently working on a general education science course based on a problem-based learning approach.

Steven E. Wendel
Assistant Professor,
Industrial Design
& Graphic Technology
Sinclair Community College
Dayton, Ohio

Wendel is presently working to develop student-centered, self-paced learning modules for delivery in Sinclair Community College's new Center for Interactive Learning. He leads Rapid Prototyping efforts at Sinclair and recently developed a Plastic and Composites Technology Program.

Steven J. Wolf
Associate Professor, Botany
California State University, Stanislaus
Turlock, California

Wolf is administrator of the Biological Sciences Web server at California State University, Stanislaus (CSUBIOWEB) and director of the university's Biology Lab Online Project.

Carol Wood
Assistant Professor,
Physical Education
Salisbury State University
Salisbury, Maryland

Wood has consistently implemented technology into her classes during her 10 years of experience in higher education. She has given numerous presentations on the use of technology in her classes by training students in technology advances such as the World Wide Web and PC applications.

Annette Wyandotte
Co-Coordinator, Writing Program
& Assistant Professor, English
Indiana University Southeast
New Albany, Indiana

Wyandotte came to academe as an experienced lawyer and former secondary English teacher in public and parochial schools. She co-coordinates the writing program at Indiana University Southeast and teaches a variety of courses in writing, language and literature.